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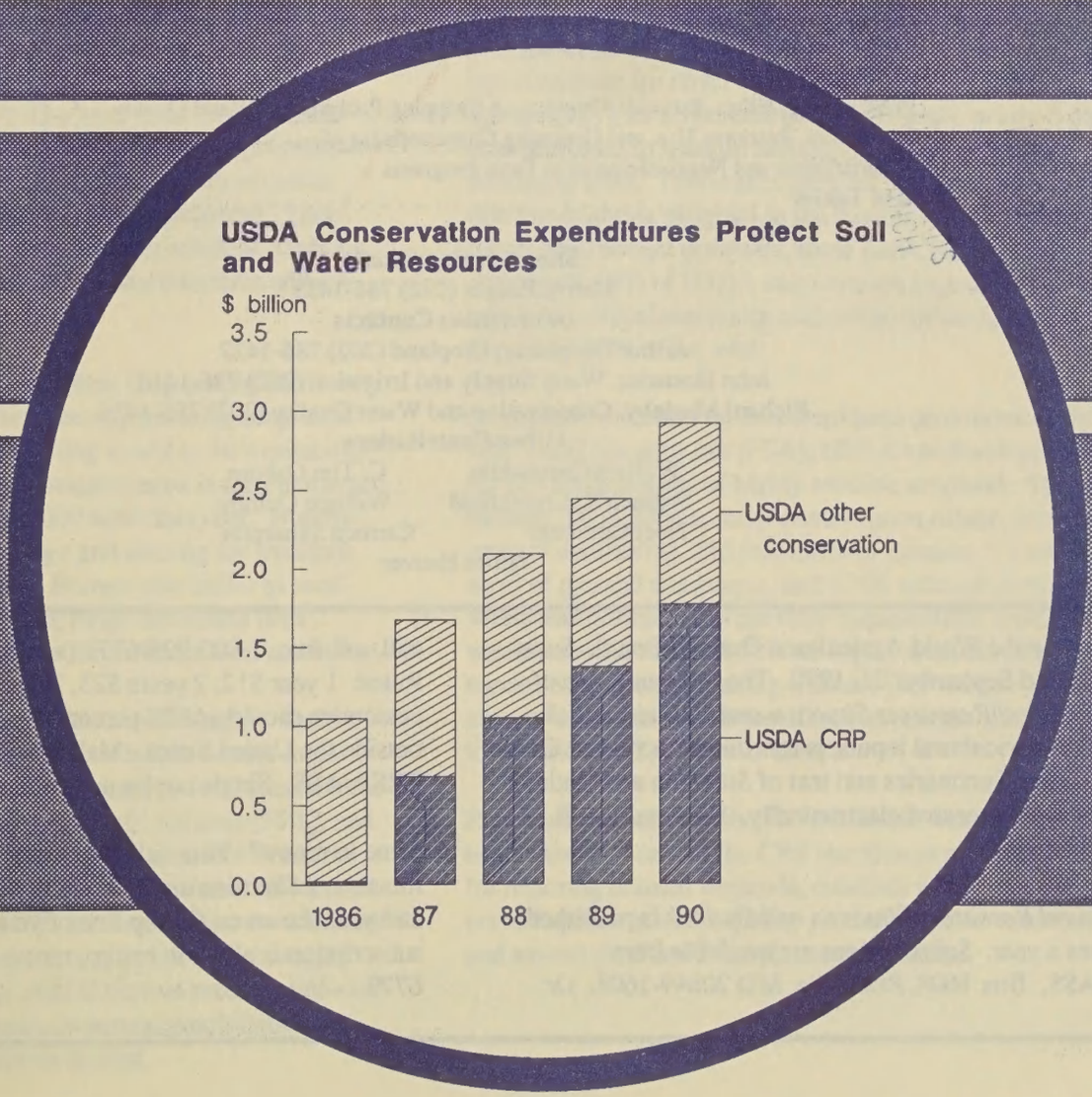
Situation and Outlook Report



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Summary

Farmers made little change in 1990 cropland use as Congress prepared new farm legislation. However, cropland harvested in 1990 is expected to be up slightly, with less failure and fewer acres of summer fallow as soil moisture conditions improved over the midcontinent and much of the eastern region. Ground water supplies enabled the maintenance of near-normal irrigated acreage levels, even in the face of continued drought in the West. Farmers continue to carry out the conservation provisions of the 1985 farm legislation by adopting practices that reduce erosion and enhance water quality.

Above-normal rainfall and increased soil moisture in most of the rainfed crop production regions this year are in sharp contrast to last year's drought in the Central Plains and western Corn Belt. Cropland used for crops in 1990—harvested, failed, and fallowed—is 342 million acres, up 1 million from 1989. Harvested cropland, estimated at 311 million acres, is up 5 million from a year ago. Crop failure is estimated to be near normal this year with about 6 million acres abandoned. Summer fallowed land, estimated at 25 million acres and located mainly in the 17 Western States, is down 2 million from a year ago. Overall, 1990 acreage is down 45 million from the 1981 peak, but up 15 million from the 1988 low.

Federal programs idled nearly 60 million acres this year, down 1 million from 1989. The long-term Conservation Reserve Program (CRP) accounts for over half (34 million acres) of the idled land and annual commodity set-aside requirements for the remainder (26 million acres). This year's decrease in idled land was the net result of 5 million fewer acres idled by annual commodity programs and a 4-million-acre increase in the CRP.

Parts of 10 States in the West, where crop production depends heavily on irrigation, are experiencing long-term drought. The drought is beginning to affect the availability of irrigation water, with total irrigated area in the Pacific and Southwest regions down 200,000 acres this year. Nonirrigated crops and available forage and grazing for livestock have been severely impacted. Forests also suffer as seedlings and even mature trees die, range and forest fires become harder to control, and wildlife lacks food and cover.

Reservoirs and summer streamflows which supply surface water for irrigation are at levels well below normal in parts of the West. Reservoir levels entering the 1990 season were critically low in Nevada (45% normal), Arizona (55%), and California (70%), and below normal in six other Western States. Streamflow forecasts were 30% or more below average for most of the irrigated West. Restrictions on water use for agriculture are expected to occur in 1991 as shortages will continue into next year even if normal precipitation resumes. It will take several years of normal precipitation to return reservoirs and streams to normal.

The President's Water Quality Initiative, aimed primarily at protecting the Nation's drinking water, calls for new actions to reduce the potential for contamination from agricultural pesticides and fertilizers. USDA activities supporting the initiative include research to develop more environmentally sound farming systems, collection of information to evaluate farm decisions on chemical use, and education and technical assistance to accelerate farmers' adoption of improved practices. State and Federal agencies, including the Environmental Protection Agency and U.S. Geological Survey, are cooperating in these efforts.

Soil conservation activities continue to reduce erosion and enhance water quality. The CRP, with 34 million acres of highly erodible or environmentally sensitive land now enrolled, is expected to reduce erosion annually by over 655 million tons, approximately 21 percent of all erosion generated by cropland prior to the program. In exchange for retiring highly erodible and/or environmentally sensitive cropland for 10 years, farmers receive from the CRP an annual rent and half the cost of establishing a permanent vegetative cover on the land.

The CRP rental payments for currently enrolled acreage will average about $1.7 billion annually through 1995. The Federal cost share for cover establishment totaled about $1.3 billion to date, with 88 percent planted to grass, nearly 6 percent dedicated to wildlife habitats, and over 6 percent planted to trees. This makes the CRP the largest conservation tree-planting program in the Nation's history. According to 1990 budget estimates, these two CRP items will represent over 60% of USDA conservation expenditures. Outlays for technical assistance and extension services constitute about 15% of the total.

In response to conservation compliance provisions of the 1985 Food Security Act (FSA), USDA has developed plans for 135 million acres of highly erodible cropland. The plans include 100 million acres of conservation tillage, 25 million acres of contouring, 215,000 miles of terraces, 1.3 million acres of grassed waterways, and 4,700 miles of diversions. When and if these plans are fully implemented, erosion would be reduced about 50% on highly erodible land. Implementation of the plans along with the CRP would reduce average annual cropland erosion by about one-third from the level estimated for the mid-1980's.

Proposals contained in the 1990 farm bill would target additional land and extend the CRP enrollment period, provide for restoring drained wetlands, establish a program for farmers to implement water quality protection plans voluntarily, and amend the FSA Swampbuster provisions.

Acreage Up Slightly from 1989

About 342 million acres are expected to be used for crops in 1990, up 1 million (0.3 percent) from last year (table 1). After peaking at 387 million in 1981, when no acreage was idled under Federal programs, crop acreage trended downward through 1988.

The decline from 1981 to 1988 was mainly due to increased farmer participation in Federal programs aimed at limiting crop production or soil erosion. In 1989, land idled by Federal programs declined 22 percent (16.9 million acres) from 1988 and, in 1990, declined only about 1 percent (0.9 million acres). As expected, cropland increased in 1990—but only slightly from 1989.

Federal programs idled nearly 60 million acres in 1990, about 1 million less than in 1989 but significantly less than the 1988 peak of 78 million acres (table 1, fig. 1). This year's continued decrease in cropland idled by Federal programs was the net outcome of almost 5 million fewer acres idled in annual crop programs offset by about 4 million acres newly enrolled in the Conservation Reserve Program (CRP). The decline in land idled by Federal programs in 1990 (and in 1989) reflects a combination of lower program participation by producers than during the 1986-88 period, lower set-aside requirements for some program crops, and availability of modified contracts for wheat.

Farmers intend to harvest 311 million acres of the 19 principal crops, which together with minor crops may raise total harvested acres in 1990 to more than 323 million. More than 12 million acres are estimated to be double cropped. After allowing for double cropping, harvested cropland is expected to total 311 million acres, 5 million above last year but 40 million below the 1981 record.

Because double cropping is about equal to the total acreage of vegetables, fruits, and other minor crops, the estimated total **cropland** harvested is equal to the area of **principal crops** harvested. Since harvesting is still underway in many areas, these estimates will likely change.

Nearly 25 million acres were summer fallowed in 1990, down 2 million from 1989 (table 1). No doubt some land normally summer fallowed has been contracted into the CRP. Along with lower set-aside requirements for most program crops, this accounts for the decline in land summer fal-

Figure 1
Major Uses of U.S. Cropland

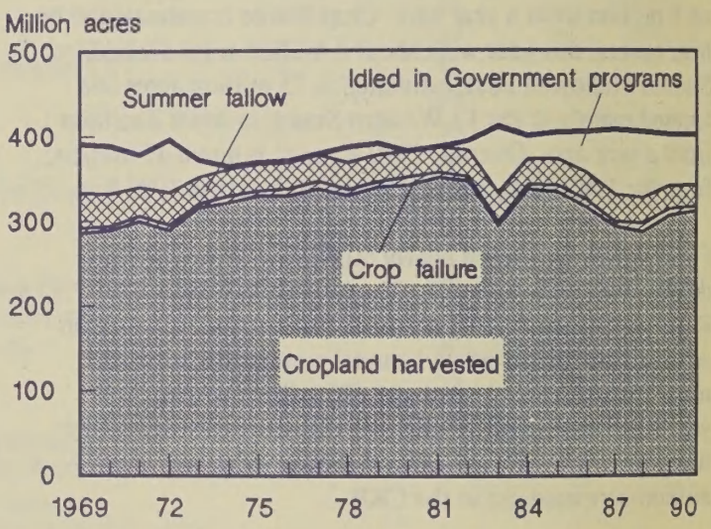


Table 1--Major uses of cropland, United States 1/

Cropland	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 2/
					Million acres					
Cropland used for crops	387	383	333	373	372	357	331	327	341	342
Cropland harvested 3/	351	347	294	337	334	316	293	287	306	311
Cropland failure	6	5	5	6	7	9	6	10	8	6
Cultivated summer fallow	30	31	34	30	31	32	32	30	27	25
Cropland idled by all Government programs	0	11	78	27	31	48	76	78	61	60
Annual programs	0	11	78	27	31	46	60	53	31	26
Long-term programs	0	0	0	0	0	2	16	25	30	34
Total, specified uses 4/	387	394	411	400	403	405	407	405	402	402

1/ Includes the 48 conterminous States. Fewer than 200,000 acres were used for crops in Alaska and Hawaii. 2/ Preliminary. 3/ A double-cropped acre is counted as one acre. 4/ Does not include cropland pasture or idle land not in Federal programs that is normally included in the total cropland base.

lowed since 1987. Crop failure is estimated at more than 6 million acres, about 2 percent of the planted acreage. Crop failure has declined from 1989 and 1988, when severe drought devastated several regions, and is about the same as in 1987 and for several years in the early 1980's.

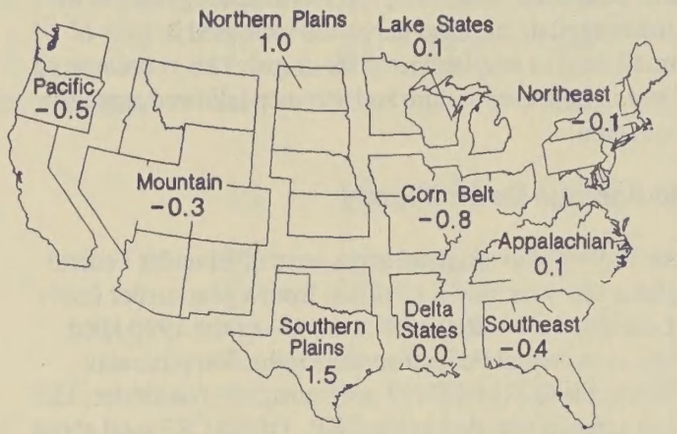
U.S. agricultural exports are expected to increase slightly in 1990. Stocks of feed grain, including corn, sorghum, and barley, will remain at relatively low levels.

Plains Farmers Use Nearly 3 Million More Acres

Cropland used for crops in 1990 is higher than last year in 4 of the 10 farm production regions (table 2, fig 2). Cropland used for crops increased most in the Southern and Northern Plains regions—1.5 million and 1.0 million acres. These regions also had the highest estimated increase in cropland harvested—2.3 million acres in the Southern Plains and 3.8 million acres in the Northern Plains.

The increase in cropland acres in the Plains regions is due largely to the increase in wheat acreage (see table 6). In addition, 0.6 million fewer acres were idled in Federal programs in the Southern Plains in 1990 than in 1989 (table 3). Cropland idled in Federal programs increased 0.3 million acres in the Northern Plains from 1989-90. Much smaller increases in acreage of cropland used for crops occurred in the Appalachian and Lake States regions.

Figure 2
Change in Cropland Used for Crops by Farm Production Region, 1989-90



In million acres.

Table 2--Cropland used for crops in 1990, and 1989-90 change, by region

Region	Cropland used for crops 1/				Share of all cropland used for crops
	Cropland harvested	Crop failure	Summer fallow	Total	
1990:	Million acres				Percent
Northeast	11.4	0.1	-	11.5	3.4
Lake States	33.9	0.3	-	34.2	10.0
Corn Belt	79.4	1.4	-	80.8	23.7
Northern Plains	75.1	1.3	12.2	88.6	25.9
Appalachian	16.6	0.3	-	16.9	4.9
Southeast	10.1	0.2	-	10.3	3.0
Delta States	14.7	0.3	-	15.0	4.4
Southern Plains	28.4	1.9	1.2	31.5	9.2
Mountain	25.6	0.4	8.5	34.5	10.1
Pacific	15.4	0.2	2.6	18.2	5.3
United States 2/	310.6	6.4	24.5	341.5	100.0
1989-90 change:	Million acres				
Northeast	-0.1	0.0	0.0	-0.1	
Lake States	0.2	-0.1	0.0	0.1	
Corn Belt	-1.6	0.8	0.0	-0.8	
Northern Plains	3.8	-1.1	-1.7	1.0	
Appalachian	0.0	0.1	0.0	0.1	
Southeast	-0.4	0.0	0.0	-0.4	
Delta States	0.1	-0.1	0.0	0.0	
Southern Plains	2.3	-0.6	-0.2	1.5	
Mountain	0.5	-0.5	-0.3	-0.3	
Pacific	-0.5	-0.1	0.1	-0.5	
United States 2/	4.3	-1.6	-2.1	0.6	

- = None or fewer than 100,000 acres.

1/ Preliminary. Based on farmers' intentions to harvest. 2/ Includes the 48 conterminous States. Fewer than 200,000 acres were used for crops in Alaska and Hawaii. Breakdown may not sum to totals due to rounding.

The Corn Belt, where cropland used for crops increased by 6 million acres from 1988 to 1989, experienced a decline of 0.8 million acres from 1989 to 1990 (table 2, fig 2). Soybean acreage declined 1.0 million in the Corn Belt and oats declined 0.3 million acres. Wheat acreage, on the other hand, increased as did corn.

Smaller declines in cropland used for crops occurred in the Pacific, Southeast, Mountain, and Northeast regions. In the Mountain region, cropland harvested increased in spite of the small drop in cropland used for crops. This is because of declines in both crop failure and summer-fallowed acreage in the region.

Idled Acreage Down Slightly

About 59.9 million cropland acres were idled under Federal programs this year, down 1 million from a year earlier (table 3). Less than half—26.0 million acres—of the 1990 idled acreage is in annual Federal acreage reduction programs (including the 0/92 and 50/92 programs); the remainder, 33.9 million acres, is enrolled in the CRP. Of the CRP total about 21.8 million acres are base acres (table 4). The total acreage idled by annual programs declined about 5 million acres from 1989 to 1990. Among the major program crops, only barley had a greater acreage set-aside in 1990 than in 1989. The decline in acreage idled by annual programs was partially due to changes in the wheat, cotton, and rice programs.

However, an additional 2.8 million base acres, bid into the CRP, offset part of the annual program decrease. Net base acreage idled in 1989 decreased by 2.1 million from a year earlier. The difference between the total idled acreage in table 3 and in table 4 represents nonbase acres idled by the CRP in 1986 through 1990.

All acreage enrolled in the CRP must remain idle for the full 10-year life of the CRP contract. Base acreage in the CRP is preserved and will return as effective base acreage eligible for program participation at the end of the CRP contract (table 5).

Participation in the 1991 commodity programs is expected to remain strong as many producers continue to rely on deficiency payments to supplement their production returns. Additional enrollments in the CRP may also remove more land from production.

Overall, fewer base acres were idled by annual programs in 1990 and more base acres were idled in the CRP. The net change in individual crops reveals some minor shifts between 1989 and 1990 (table 4). The only increases in net idled base acres were barley, 0.7 million acres (13 percent) and oats, 0.1 million acres (7 percent). Net idled wheat base acreage fell 1.0 million acres (5 percent), corn 0.3 million (2 percent), sorghum 0.1 million (2 percent), cotton 1.5 million acres (32 percent), and rice 0.2 million acres (17 percent).

Table 3--Cropland idled under Federal acreage reduction programs, by region

Region	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 1/
					Million acres					
Northeast	0	0.1	1.0	0.1	0.2	0.5	0.9	0.9	0.7	0.6
Lake States	0	0.7	8.0	1.6	2.1	4.0	7.0	6.8	4.7	4.7
Corn Belt	0	1.2	17.9	2.8	3.8	8.5	15.3	13.9	8.8	8.6
Northern Plains	0	3.6	20.9	9.5	10.1	14.2	19.7	20.8	15.8	16.1
Appalachian	0	0.1	2.6	0.4	0.5	1.3	2.7	3.0	2.3	2.3
Southeast	0	0.2	2.3	0.5	0.7	1.3	3.0	3.2	3.0	3.0
Delta States	0	0.6	3.5	1.3	1.9	2.4	3.6	3.1	3.0	2.7
Southern Plains	0	2.3	12.8	5.7	5.9	8.3	11.7	12.0	10.1	9.5
Mountain	0	1.7	6.1	3.9	3.9	5.4	8.7	10.2	9.1	9.3
Pacific	0	0.6	2.9	1.2	1.6	2.2	3.5	3.8	3.2	3.1
United States 2/ 3/	0	11.1	77.9	27.0	30.7	48.1	76.2	77.7	60.8	59.9
					Percent share of U.S. total					
Northeast	N.A.	0.6	1.3	0.4	0.7	1.0	1.2	1.2	1.2	1.0
Lake States	N.A.	6.3	10.3	5.8	6.8	8.3	9.2	8.8	7.7	7.8
Corn Belt	N.A.	10.5	23.0	10.4	12.4	17.7	20.1	17.9	14.5	14.4
Northern Plains	N.A.	32.4	26.8	35.2	32.9	29.5	25.9	26.8	26.0	26.9
Appalachian	N.A.	1.2	3.3	1.3	1.6	2.7	3.5	3.9	3.8	3.8
Southeast	N.A.	1.4	3.0	1.8	2.3	2.7	3.9	4.1	4.9	5.0
Delta States	N.A.	5.0	4.5	4.7	6.2	5.0	4.7	4.0	4.9	4.5
Southern Plains	N.A.	21.0	16.4	21.1	19.2	17.3	15.4	15.4	16.6	15.9
Mountain	N.A.	15.0	7.8	14.4	12.7	11.2	11.4	13.1	15.0	15.5
Pacific	N.A.	5.2	3.7	4.6	5.2	4.6	4.6	4.9	5.3	5.2
United States 2/	N.A.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1/ Preliminary. 2/ Includes the 48 conterminous States. Because of rounding, regional data may not sum to U.S. totals. 3/ Includes cropland idled by 0/92 and 50/92 programs from 1986 through 1990. Also includes 2.0 million acres enrolled in the Conservation Reserve Program in 1986, 15.7 million acres enrolled in 1987, 24.5 million acres enrolled in 1988, 29.8 million acres enrolled in 1989, and 33.9 million acres enrolled in 1990.

Table 4 --Base acreage idled under Federal acreage reduction programs, United States

Program and crop	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990 1/
						Million acres				
Annual programs:										
Corn	0	2.1	32.2	3.9	5.4	14.2	23.2	20.5	10.8	10.1
Sorghum	0	0.7	5.7	0.6	0.9	2.9	4.1	3.9	3.3	3.0
Barley	0	0.4	1.1	0.5	0.7	2.0	3.0	2.8	2.3	2.6
Oats	0	0.1	0.3	0.1	0.1	0.5	0.8	0.3	0.3	0.2
Wheat	0	5.8	30.0	18.6	18.8	21.0	23.9	22.5	9.6	7.1
Cotton	0	1.6	6.8	2.5	3.6	4.0	3.9	2.2	3.5	1.9
Rice	0	0.4	1.7	0.8	1.2	1.5	1.6	1.1	1.2	1.0
Total, annual programs 2/	0	11.1	77.9	27.0	30.7	46.1	60.5	53.3	30.9	26.0
Conservation Reserve Program: 3/										
Corn						0.1	2.3	2.8	3.4	3.8
Sorghum						0.2	1.2	1.8	2.2	2.4
Barley						0.1	1.1	1.9	2.3	2.7
Oats						0.1	0.5	0.9	1.1	1.3
Wheat						0.6	4.2	7.1	8.8	10.3
Cotton						0.1	0.7	1.0	1.2	1.3
Rice						4/	4/	4/	4/	4/
Total, Conservation Reserve Program 2/						1.2	10.0	15.5	19.0	21.8
Total base acres idled 2/	0	11.1	77.9	27.0	30.7	47.4	70.5	68.8	49.9	47.8

1/ Preliminary. 2/ Because of rounding, crop acreages may not sum to the totals. Base acreages idled under 0/92 and 50/92 programs from 1986 through 1990 are included in annual program data. 3/ Program began in 1986. Small acreages of peanut and tobacco base were bid into the CRP in addition to the crops listed. 4/ Less than 50,000 acres.

Commodity Acreage Reduction Requirements

Feed grains. Participants in the 1990 feed grain programs were required to idle at least 10 percent of their base acreage of corn, sorghum, and barley, the same as in 1989 but down from 20 percent in both 1987 and 1988. Also, there was no paid land diversion (PLD) in 1990 or 1989. In 1988, corn, sorghum, and barley producers could receive land diversion payments by idling another 10 percent of their base acreage, as well as earn deficiency payments on their planted acreage. The 1990 oats program required producers to idle 5 percent of their base acreage, the same as in 1989 and 1988.

Feed grain acreage idled in the 1990 annual program totals 16 million, compared with nearly 17 million acres last year and more than 27 million in 1988 (see table 4). In addition to the annual program participation, about 10 million acres have been enrolled in the CRP—about 9 percent of the 1990 national feed grain base acreage of 117 million acres.

Harvest estimates of feed grains are down 1.4 million acres from 1989. This is the net of an increase of 1.9 million acres of corn and a combined decrease of 3.3 million acres of sorghum, barley, and oats. Provisions of the 1991 feed grain program would normally have to be announced by September 30. However, the announcement will be delayed this year until after approval of the 1990 farm bill.

Wheat. Participating wheat growers had to idle 5 percent of their base acreage in 1990 compared with 10 percent in 1989 and 27.5 percent in 1987 and 1988. A modified contract option permitted producers to plant up to 105 percent of their wheat base, but required that wheat acreage used to compute deficiency payments be reduced by one acre for each acre above 95 percent of base. Therefore, if 105 percent of the wheat base is planted, producers will receive deficiency payments on 85 percent.

The increased plantings cannot be used to build base, but if acreage of other program crops is reduced to plant the added wheat, farmers will not lose base on those crops. More than 19 million of the 67 million acres (28 percent) enrolled in the 1990 wheat program were under modified contracts.

A total of 7.1 million acres of wheat base was idled in the annual program, down nearly 3 million from last year. Also, 10.3 million acres of wheat base were enrolled in the CRP for 1990, an increase of 1.5 million acres from last year. Wheat harvest is estimated on 69.9 million acres in 1990, up 7.8 million from last year (table 6). Maximum wheat Acreage Reduction Program (ARP) requirements have been tentatively announced to be 10 to 20 percent for 1991. This projection was announced by Secretary of Agriculture Clayton Yeutter for wheat producers' planning purposes pending approval of the 1990 farm bill.

Cotton and rice. Participation in the upland cotton program in 1990 required idling of 12.5 percent of upland cotton base, half that of 1989 but the same as in 1988. Thus, 1990 participation equivalent to 1989 would have reduced upland cotton set-aside acres by 50 percent. A total of 1.9 million acres of cotton was idled, down 1.6 million or nearly 46 percent from 1989. There was no change in the extra-long staple cotton program.

Participation in the rice program in 1990 required idling 20 percent of base acres compared with 25 percent in 1989. As with cotton, equivalent program participation would have reduced acres idled from 1989—by 20 percent. Actual participation in the rice program resulted in 1.0 million acres of rice base idled, down about 0.2 million or nearly 17 percent fewer than in 1989.

In addition, 1.3 million cotton base acres and 12,845 rice base acres were enrolled in the CRP for 1990. Provisions of the upland cotton program for 1991 normally would have to be announced by November 1, 1990 but may be delayed pending passage of the 1990 farm bill.

Idled Acreage Up In Only Two Regions

Between 1989 and 1990, total acreage idled (under annual programs and the CRP) decreased or was unchanged in all but the Northern Plains and Mountain farm production regions (table 3). Proportionately, the greatest decrease occurred in the Northeast, where 14 percent less acreage was idled in 1990 than a year earlier, followed by the Delta States with 10 percent fewer acres idled in 1990.

Participation in the annual crop programs changed very little in 1990 from 1989. Enrolled base acres in 1990 increased less than 0.1 percent from the complying base acreage in 1989. More than 80 percent of the decrease in acres idled by annual programs occurred in wheat and cotton, where the set-aside requirements were reduced or a modified contract option was available (wheat). Cropland idled by annual programs in the Delta States, Northern Plains, and Northeast regions dropped 20 percent or more this year, mostly due to smaller set-aside requirements.

Decreases in the other regions ranged from 10 to 19 percent in the Mountain, Pacific, Lake States, Corn Belt, and Southern Plains regions and were less than 10 percent in the Appalachian and Southeast regions. In contrast, enrollment in the CRP rose in all regions, and the 1989 to 1990 increase in base acreage idled by the CRP totalled 2.8 million acres (table 4).

Base Acreage Down From 1985 Peak

Total base acreage of major program crops—wheat, feed grains, cotton, and rice—reached a peak for the 1980's at 240.3 million acres in 1985 (table 5). However, since 1986 the CRP has cut the effective base acreage in each subsequent crop year, until in 1990 it is lower than in any year in the decade.

Complying base acreage is the portion of the effective base acreage operated by producers who chose to participate in annual commodity programs. Participation in annual crop programs varies for several reasons, including the attractiveness of program provisions and the outlook for crop prices. The proportion of the effective base complying (enrolled) in

Table 5--Principal and program crops planted, total base acreage, and other Federal program acreage statistics and relationships

Item	1982	1983	1984	1985	1986	1987	1988	1989	1990 1/
					Million acres				
Principal crops planted	358.6	309.4	344.9	342.1	326.9	304.9	307.8	316.8	319.7
Program crops planted	222.3	189.3	215.3	216.8	204.0	185.4	182.8	196.1	196.3
Total base acreage of program crops	229.9	229.8	234.4	240.3	235.0	236.4	239.2	239.0	238.4
Base acres in CRP 2/					1.2	10.0	15.5	19.0	21.8
Effective base acreage 3/	229.9	229.8	234.4	240.3	233.8	226.4	223.7	220.0	216.6
Complying base acreage	96.9	168.1	128.6	162.8	192.9	197.2	187.8	168.0	168.8 4/
Annual program set-aside	11.1	77.9	27.0	30.7	46.1	60.5	53.3	30.9	26.0
Complying base minus set-aside	85.8	90.2	101.6	132.1	146.8	136.7	134.5	137.1	142.8 4/
Complying base planted	73.7	79.8	88.0	116.1	135.5	131.6	125.0	123.1	NA
					Percent				
Effective base acreage as percentage of principal crops planted	64.1	74.3	68.0	70.2	71.5	74.3	72.7	69.4	67.8
Complying base acreage as percentage of effective base acreage	42.1	73.2	54.9	67.7	82.5	87.1	84.0	76.4	77.9 4/
Complying base acreage as percentage of program crops planted	43.6	88.8	59.7	75.1	94.6	106.4	102.7	85.7	86.0 4/
Complying base planted as percentage of program crops planted	33.2	42.2	40.9	53.6	66.4	71.0	68.4	62.8	NA

NA = Not available.

1/ Preliminary. 2/ Program began in 1986. 3/ Total base acreage of program crops less base acres in CRP. 4/ Based on enrolled base acres for current crop year.

1990 is 77.9 percent, up 1.5 percentage points from 1989, but down 9.2 points from the peak participation in 1987 (table 5).

The maximum acreage that program participants may plant is the complying base acreage minus the acreage required to be idled (set aside). Because not all program participants plant up to their maximum acreage, the complying base actually planted is less. Many producers use the 0/92 and 50/92 programs to idle additional acreage.

Total acreage of program crops planted includes the acreage planted by nonparticipants as well as the complying base planted by program participants. In 1989, only 62.8 percent of the acreage of all program crops was produced by participants in annual Federal programs. The proportion of program crop acreage enrolled in Federal programs rose from 33 percent in 1982 to 71 percent in 1987 and has declined since 1987.

Wheat, Corn, Cotton, Rice Acreage Up in 1990

Harvested acreage of wheat, corn, cotton, and rice is expected to rise in 1990, while for soybeans and other feed grains (sorghum, barley, and oats) it is estimated to fall (table 6). Total harvested cropland is expected to be up 4.3 million acres from a year earlier (table 2).

The increase in harvested acreage is due partly to the decline in land idled in Federal programs. Land idled by programs has decreased or is unchanged from 1989 in all but the Northern Plains and Mountain regions. In addition, lands on which crops failed and which were summer fallowed declined from 1989. Besides the increase of more than 4 million acres in harvested cropland, considerable shifting among crops helped to produce the increased acreage of wheat, corn, and cotton.

Wheat acreage harvested in 1990 is estimated at 69.9 million acres, up 7.8 million from a year ago and up 9.6 million acres from the 1984-88 average. The expected increase results in part from 2.5 million fewer acres of wheat base idled. All regions except the Appalachian, Northeast, and Southeast show gains in harvested acres. The increases were particularly large in the Northern Plains (4.2 million acres) and Southern Plains (1.8 million) regions.

Harvested corn acreage in 1990 is forecast at 66.7 million, up 1.9 million from a year earlier. Largest gains are predicted for the Northern Plains (0.7 million acres), and Lake States (0.6 million).

Harvested acreage of all cotton is expected to be 11.5 million in 1990, up 2.0 million from 1989. Land idled in the annual cotton program decreased by 1.6 million acres, but another 0.1 million acres of cotton base were enrolled in the CRP for the 1990 crop year. The net decrease in idling of cotton base accounts for about 75 percent of the expected increase in cotton harvest. The increase in cotton acreage is greatest in the Southern Plains (1.2 million acres) followed by the Delta States, Southeast, and Appalachian regions. A small decrease in cotton acreage occurred in the Mountain region, while cotton acreage in the Corn Belt and Pacific regions was unchanged.

Sorghum acres harvested for grain in 1989 are estimated at 9.3 million, down 1.9 million from a year earlier. The acreage of sorghum declined or was unchanged in all regions that normally produce sorghum. The largest decrease from 1989 was in the Northern Plains (1.2 million acres), which reported the largest increase in wheat and corn acreage.

Soybeans are expected to be harvested on 56.6 million acres in 1990, about 2.8 million less than in 1989. Soybean acreage declined in all the regions that normally produce this crop. As with sorghum, the greatest declines in acreage occurred in regions showing increases in acreage of corn, wheat, and/or cotton.

Production Per Acre Rebounds in 1989

The U.S. index of crop production per acre of cropland used for crops was 119 (1977=100) in 1989, up from 107 in 1988 and back to about the average of the 1985-87 period (table 7). Despite the sharp increase in productivity nationally, 2 of the 10 farm production regions—the Delta States and Southern Plains—experienced decreases.

The Lake States registered a gain of 46 percent in 1989, followed by the Corn Belt (34 percent), Northeast (14 percent), Appalachian (9 percent), Northern Plains (7 percent), Mountain (5 percent), and Southeast (2 percent). Crop production per acre was unchanged from 1988 in the Pacific region.

In spite of the increases, productivity in several regions was still below that of the 1985-87 period. The Northern Plains was 17 percent below the 1985-87 average; the Corn Belt, 7 percent below; and the Southern Plains, 3 percent below.

On a more positive note, crop production per acre of cropland used for crops was at an all-time high in the Southeast in 1989 and remained unchanged from the 1988 peak in the Pacific region.

Exports Up Slightly; 1989 Acreage Equivalent Down

Exports of U.S. agricultural products in fiscal 1990 are forecast at 148.5 million tons, up just over 1 percent from a year earlier. Reduced exports of wheat, rice, and oilseeds and products are expected, primarily due to ample supplies abroad. However, increases in exports of corn, soybeans, cotton, and other minor commodities are expected to raise the volume of exports above 1989.

Table 6--Harvested acreage of major crops, by region

Crop	Period	North-east	Lake States	Corn Belt	Northern Plains	Appa-lachian	South-east	Delta States	Southern Plains	Mountain	Pacific	United States 1/
						Million acres						
Corn: 2/												
	1984-88 Ave.	2.6	10.7	33.5	11.3	3.9	1.6	0.4	1.5	0.9	0.4	66.8
	1989	2.1	10.4	33.4	11.5	3.1	1.1	0.3	1.5	1.1	0.3	64.8
	1990	2.3	11.0	33.5	12.2	3.2	1.2	0.4	1.6	1.0	0.3	66.7
Sorghum: 2/												
	1984-88 Ave.	-	-	1.3	5.9	0.3	0.2	1.1	3.8	0.5	-	13.1
	1989	-	-	0.7	5.7	0.1	0.1	0.5	3.5	0.6	-	11.2
	1990	-	-	0.7	4.5	0.1	0.1	0.4	3.2	0.3	-	9.3
Barley:												
	1984-88 Ave.	0.2	1.1	-	3.9	0.2	-	-	-	3.5	1.5	10.5
	1989	0.2	0.9	-	3.3	0.1	-	-	-	2.9	0.9	8.3
	1990	0.1	0.9	-	3.2	0.1	-	-	-	2.7	0.7	7.7
Oats:												
	1984-88 Ave.	0.5	2.0	1.2	2.4	0.1	0.1	-	0.3	0.3	0.2	7.1
	1989	0.5	1.9	1.3	2.2	0.1	0.1	-	0.3	0.3	0.2	6.9
	1990	0.4	1.7	1.0	2.2	0.1	0.1	-	0.3	0.2	0.1	6.2
Wheat:												
	1984-88 Ave.	0.6	3.3	4.1	24.7	1.5	1.3	1.6	9.6	9.6	4.0	60.3
	1989	0.7	3.5	5.8	24.8	1.8	1.4	2.0	8.7	9.5	3.9	62.1
	1990	0.6	3.8	6.4	29.0	1.8	1.2	2.2	10.5	10.3	4.1	69.9
Soybeans:												
	1984-88 Ave.	1.0	6.3	30.2	6.2	4.7	3.2	8.0	0.5	-	-	60.1
	1989	1.2	6.5	30.0	6.9	4.5	2.8	6.8	0.7	-	-	59.4
	1990	1.1	6.1	29.0	6.7	4.3	2.2	6.7	0.5	-	-	56.6
Cotton:												
	1984-88 Ave.	-	-	0.2	-	0.5	0.7	2.2	4.9	0.4	1.2	10.1
	1989	-	-	0.2	-	0.6	0.7	2.2	4.1	0.6	1.1	9.5
	1990	-	-	0.2	-	0.8	0.9	2.7	5.3	0.5	1.1	11.5
Rice:												
	1984-88 Ave.	-	-	0.1	-	-	-	1.8	0.3	-	0.4	2.6
	1989	-	-	0.1	-	-	-	1.9	0.3	-	0.4	2.7
	1990	-	-	0.1	-	-	-	2.0	0.3	-	0.4	2.8

- = None or fewer than 500,000 acres

1/ Includes the 48 conterminous States. Because of rounding, regional acres may not sum to U.S. totals.
2/ Corn and sorghum for grain.

Table 7--Indices of crop production per acre of cropland used for crops, by region

Region	1981	1982	1983	1984	1985	1986	1987	1988	1989 1/
					1977 = 100				
Northeast	112	114	104	116	120	113	115	100	114
Lake States	106	114	101	110	114	114	122	81	118
Corn Belt	114	117	88	105	124	124	123	86	115
Northern Plains	116	120	102	118	129	131	127	100	107
Appalachian	118	120	88	116	111	96	97	103	112
Southeast	130	133	122	129	135	122	143	151	154
Delta States	110	118	98	118	114	106	120	132	125
Southern Plains	106	91	97	100	105	93	114	116	101
Mountain	117	116	110	107	104	112	125	117	123
Pacific	112	115	114	121	124	122	147	148	148
United States 2/	115	116	100	112	120	116	123	107	119

1/ Preliminary. 2/ Includes the 48 conterminous States.

Acreage equivalents of exports are estimated by dividing U.S. export volumes of individual commodities by respective per-acre yields. The 1989 acreage equivalent is estimated at 102 million, down about 14 percent from 118 million in 1988 (table 8). Although this acreage equivalent is above the 1984-86 period, it remains below the levels during most of the 1980's.

An increase in productivity per crop-acre of more than 11 percent in 1989 accounts for the decline of nearly 14 percent in the acreage equivalents of exported crops. Export volume dropped less than 2 percent during this period.

The acreage equivalent of food grains exported in 1989 is estimated at 45 million, up about 2 percent from a year earlier. Feed grain exports are estimated to approximate the production of 22 million acres, down 9 million (29 percent) from 1988. The 1989 estimated acreage equivalent of oil crops is 18 million acres, cotton 5 million, and other exported products 11 million. Export equivalents in 1989 are expected to equal 32 percent of all acres harvested (table 8), compared with 40 percent in 1988.

Food grains represent 44 percent of total acreage equivalents in 1989, feed grains 22 percent, and oil crops 18 percent. Although the mix of exports has varied each year, the acreage equivalent of exports tended to increase during the 1970's, decrease from 1980 to 1985, and rise again since 1985 (fig. 3). The acreage equivalents of other crops exported have trended upward since the early 1970's, although as a percentage of all crops exported, they are still at the 1985 level.

Figure 3
Acreage Equivalents of U.S. Crops Exported

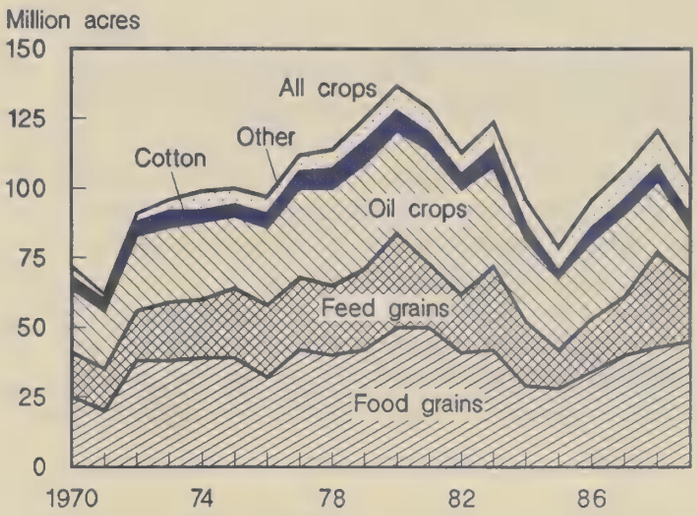


Table 8--Acreage equivalents of U.S. crops exported, 1981-89 1/

Cropland	1981	1982	1983	1984	1985	1986	1987	1988	1989 2/
					Million acres				
All crops harvested 3/	366	362	306	348	342	325	302	298	318
Used for exports:									
Food grains	50	41	42	29	28	33	42	44	45
Feed grains	23	21	30	23	14	19	20	31	22
Oil crops	41	38	36	30	26	28	29	25	18
Cotton	6	5	7	5	2	5	4	5	5
Other products	9	8	9	9	9	10	11	13	11
Total	129	113	124	96	81	96	106	118	102
					Percent				
All crops harvested 4/	35	31	41	28	24	30	35	40	32

1/ For years beginning October 1. 2/ Preliminary. 3/ Includes all cropland harvested plus acres double cropped during the calendar year. 4/ Acreage equivalents of exports as a percentage of all crops harvested.

Above-normal rainfall and improved soil moisture in much of the United States have improved water supply conditions over major rainfed crop production regions this spring. However, the drought in the Far West has intensified due to below-normal levels of winter snows and spring rains.

Soil Moisture Improves Over Broad Area

In a broad area from the Southern and Central Plains to the Northeast and Middle Atlantic, the 1990 crop year began with better topsoil moisture conditions than either 1988 or 1989. Precipitation in the first part of the year gives a good indication of topsoil moisture conditions at the beginning of the season. Early-year measurements, to May 26, show much of the Central United States with above-normal or near-normal precipitation (fig. 4).

These conditions are a sharp contrast to last year's drought in the Central Plains and western Corn Belt (fig. 5). In fact, conditions in some areas were too wet. This limits the number of field workdays and may limit yield if crops cannot be planted on time. Shorter season crops, although generally less profitable, become more attractive to producers when waterlogged fields delay planting.

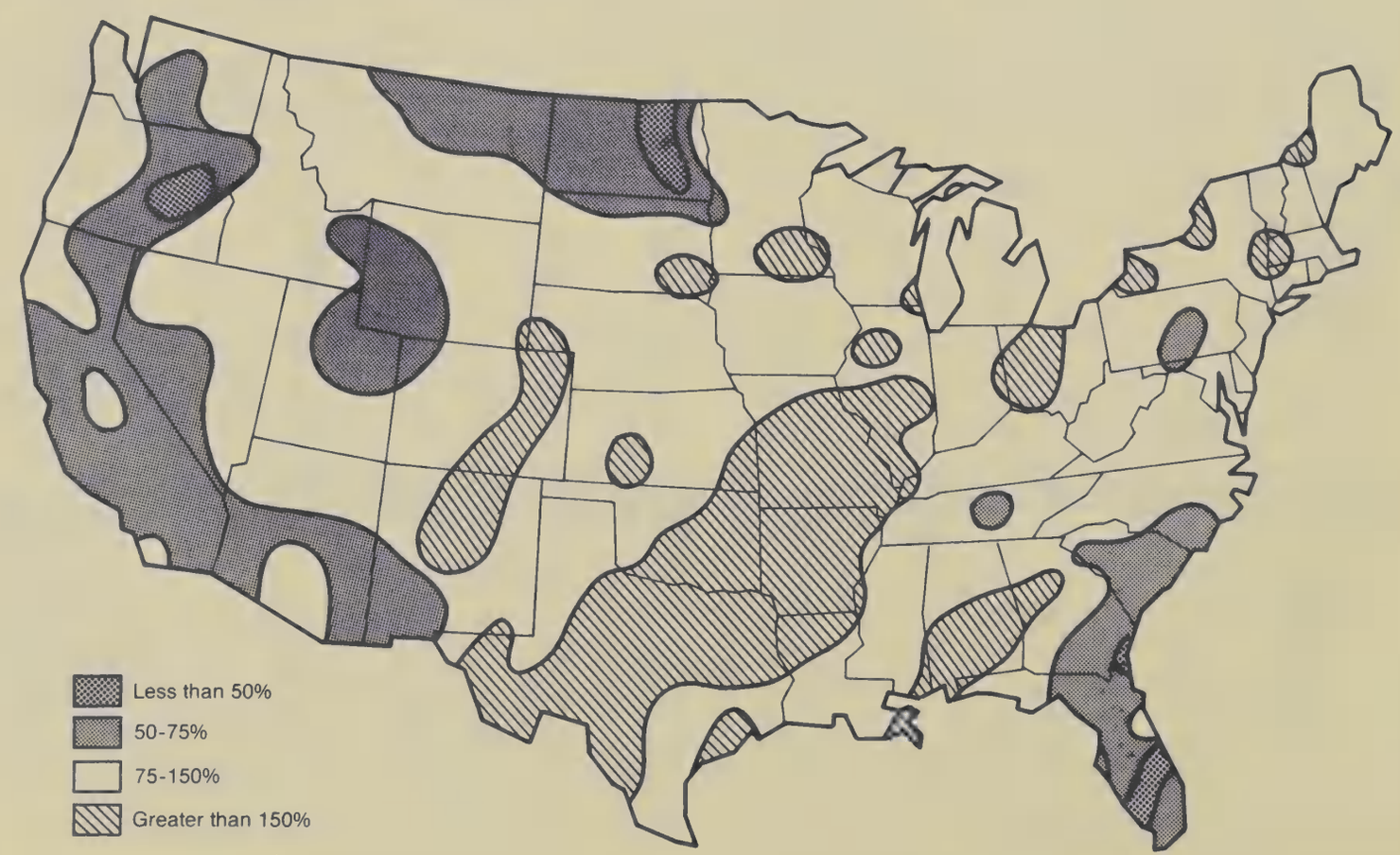
Some regions of the country were deficient in early-season topsoil moisture, as measured by precipitation (fig. 4). Areas in the Far West, particularly California and western Nevada, are in a continuing drought. Florida and southeastern Georgia have experienced a second year of below-normal early-season rain. An area of the Northern Plains is once again below normal after a devastating drought in 1988 and improved conditions last year. Soil moisture shortages have recently spread into the Carolinas and Delta States this summer.

Long-term Drought Deepens in West

In late April, an area of extreme subsoil drought stretched from California eastward to the Rocky Mountains and from

Figure 4

Percent of Normal Precipitation, January 1-May 26, 1990



Source: NOAA/USDA Joint Agricultural Weather Facility.

Mexico up the Sierra Nevadas and east of the Cascades to Canada. The drought area covers four States (California, Arizona, Nevada, and Utah), and parts of six others (New Mexico, Colorado, Wyoming, Idaho, Oregon, and Washington). Additional areas with subsoil drought conditions are southern Florida, North Dakota, southeastern South Dakota and nearby areas, and an area of the Great Lakes region (fig. 6).

Subsoil drought conditions are measured in this report by the Palmer drought severity index (PDSI), which registers long-term (months, years) abnormal dryness or wetness. The PDSI responds slowly to current precipitation and does not generally indicate current crop or field conditions. Rather, the PDSI reflects the general long-term status of water supplies in terms of runoff, aquifer recharge from deep percolation, and evapotranspiration. Secondarily, the PDSI indicates areas of decreased production risk. Producers with adequate subsoil moisture are less dependent on the amount and timeliness of summer rains for crop production.

As measured by the PDSI, the western drought area has grown compared to last year (fig. 7). Some areas of California and Nevada are in their 4th consecutive drought year. This is the 3rd drought year for parts of North Dakota. Southern Florida and the area surrounding southeastern South Dakota are in their 2nd drought year.

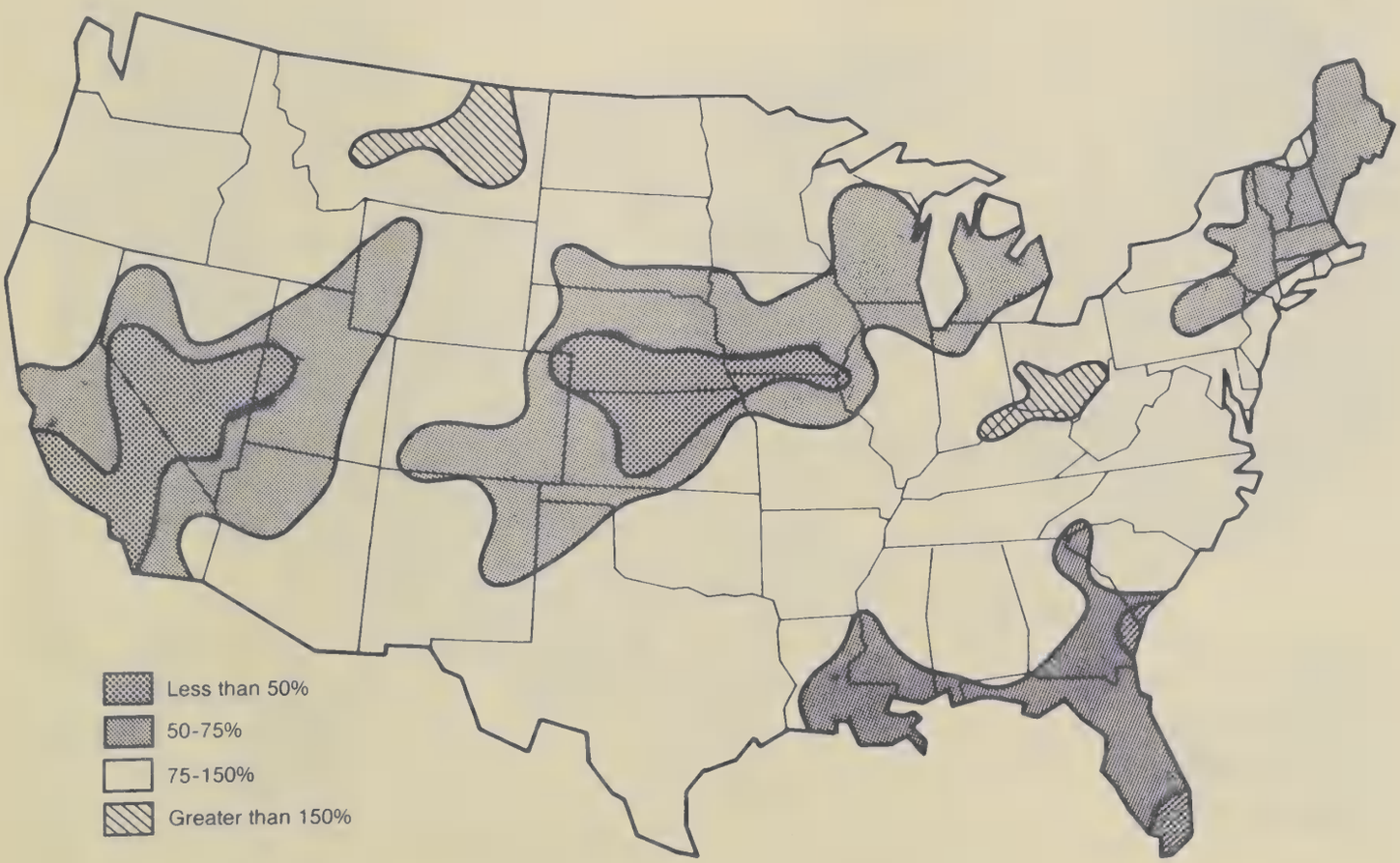
Most Agriculture Depends on Soil Moisture

Available crop moisture at the beginning of the season influences many producer decisions regarding crop selection, tillage operations, seeding rates, and other input applications. The realization of the production potential established by these decisions depends on the amount and timeliness of precipitation and many other factors. Beginning-season supplies of irrigation water influence such decisions as the number of acres to be irrigated, and the timing and application of irrigation water.

Drought conditions can and do have severe impacts on agriculture and the environment, particularly in multiyear drought areas. In addition to the expected decrease in nonirrigated crop production, range conditions deteriorate, which may lead livestock producers to liquidate herds. Forest growth suffers, and seedlings and even mature trees die from

Figure 5

Percent of Normal Precipitation, January 1-April 29, 1989



Source: NOAA/USDA Joint Agricultural Weather Facility.

moisture deficiency. Range, brush, and forest fires are more common and harder to control. Wildlife suffers from both decreased food stocks and increased pressure on available water.

Irrigated agriculture does not always experience the full impact of drought conditions. In areas not dependent on recent precipitation, adequate water supplies for irrigation generally ensure normal crop production and economic activity even in drought years. About 90 percent of the harvested cropland in California and 65 percent in the central Rockies is irrigated.

Surface Water Supplies Limit Western Agricultural Production

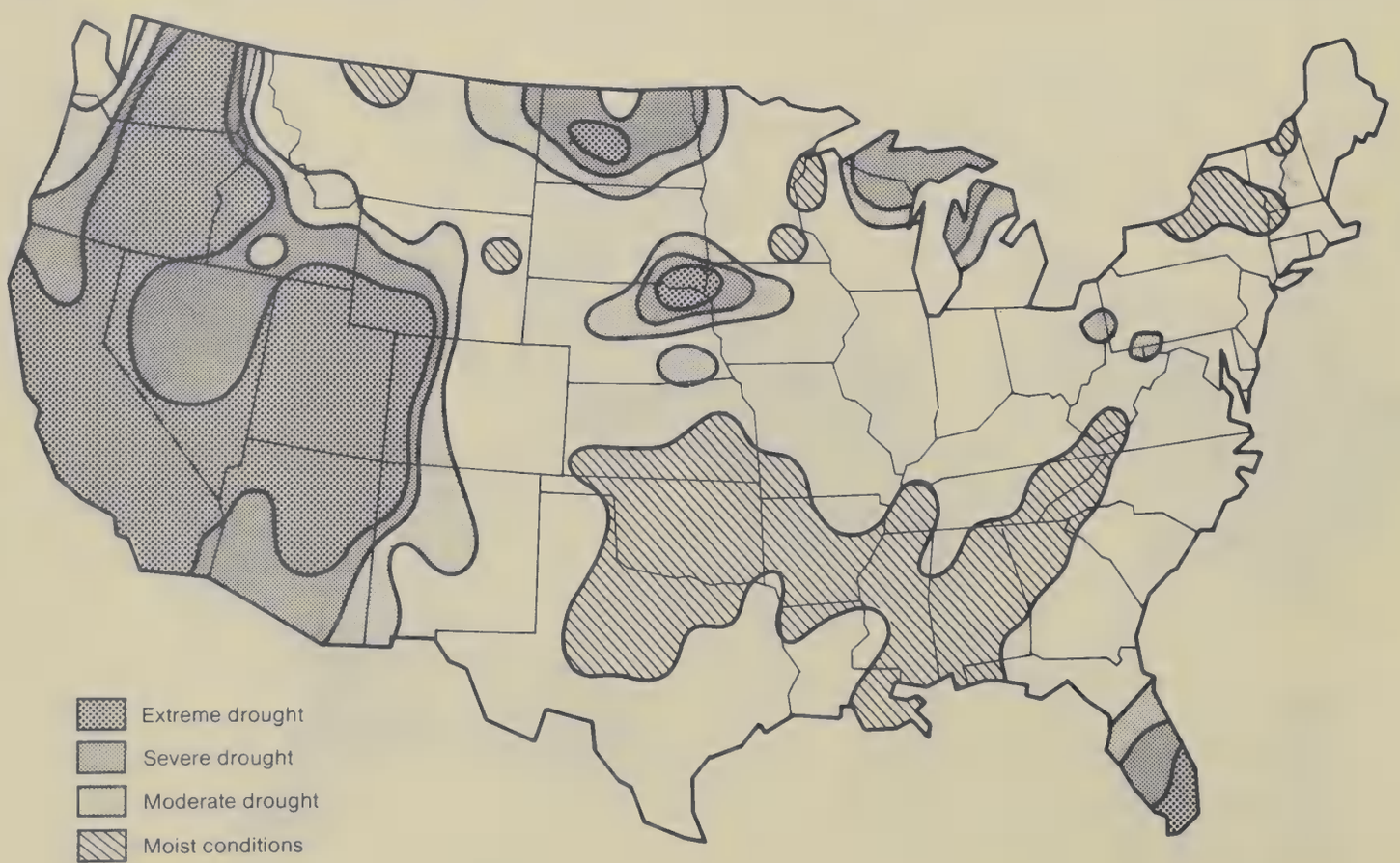
A shortage of agricultural surface water supplies for irrigation, as measured by summer streamflow and reservoir storage, is expected to limit agricultural production or induce extensive pumping of ground water. This year's lower surface water supplies result from low precipitation this spring, particularly mountain snow, and low reservoir storage caused by below-average precipitation over the past several years. Agricultural water supplies have been reduced in several Western areas, including most of California. (See the special article on page 21 for further discussion of the impact of reduced surface water on California agriculture.)

The summer streamflow forecast is poor for most of the surface-water-irrigated West: 30 percent or more below the average flow (fig. 8). Only a few areas in the Missouri River Basin and in Washington are forecast as being near normal. These streamflow forecasts are made jointly by the National Weather Service and the Soil Conservation Service for the Western United States based on observed snowpack, streamflow, and normal summer rainfall. The reason for the low streamflow forecast was an early melt of a below-average snowpack over dry soils this spring. Consequently, little snowpack was left to augment late spring and summer flows during the peak irrigation season, and dry soils intercepted runoff before it reached streams. Direct streamflow diversions serve about 10 million irrigated acres.

Most of the precipitation in the West falls as mountain snow, and reservoir releases to augment natural streamflow are required to serve about 10 million more irrigated acres.

Figure 6

Palmer Drought Severity Index, April 28, 1990



Source: NOAA/USDA Joint Agricultural Weather Facility.

Reservoirs capture and store water from wet years and wet seasons to be used in dry years and during the irrigation season. Managers of the western reservoir system carefully regulate streamflow to provide water for irrigation and instream purposes.

Reservoir levels in the Southwest were critically low entering the 1990 irrigation season. Reservoirs supplying Nevada irrigation were only 45 percent of normal levels. Arizona reservoir levels were almost as low, at 55% of normal, and California levels were near 70% of normal (fig. 9).

In addition to these three Southwestern States being at critically low levels, Oregon, Utah, Colorado, and New Mexico reported lower reservoir levels than last year. Reservoir levels for most of the northern tier of States, however (Washington, Idaho, Montana, and Wyoming), are up from 1989 (fig. 9).

Impacts of Low Surface Water Supplies

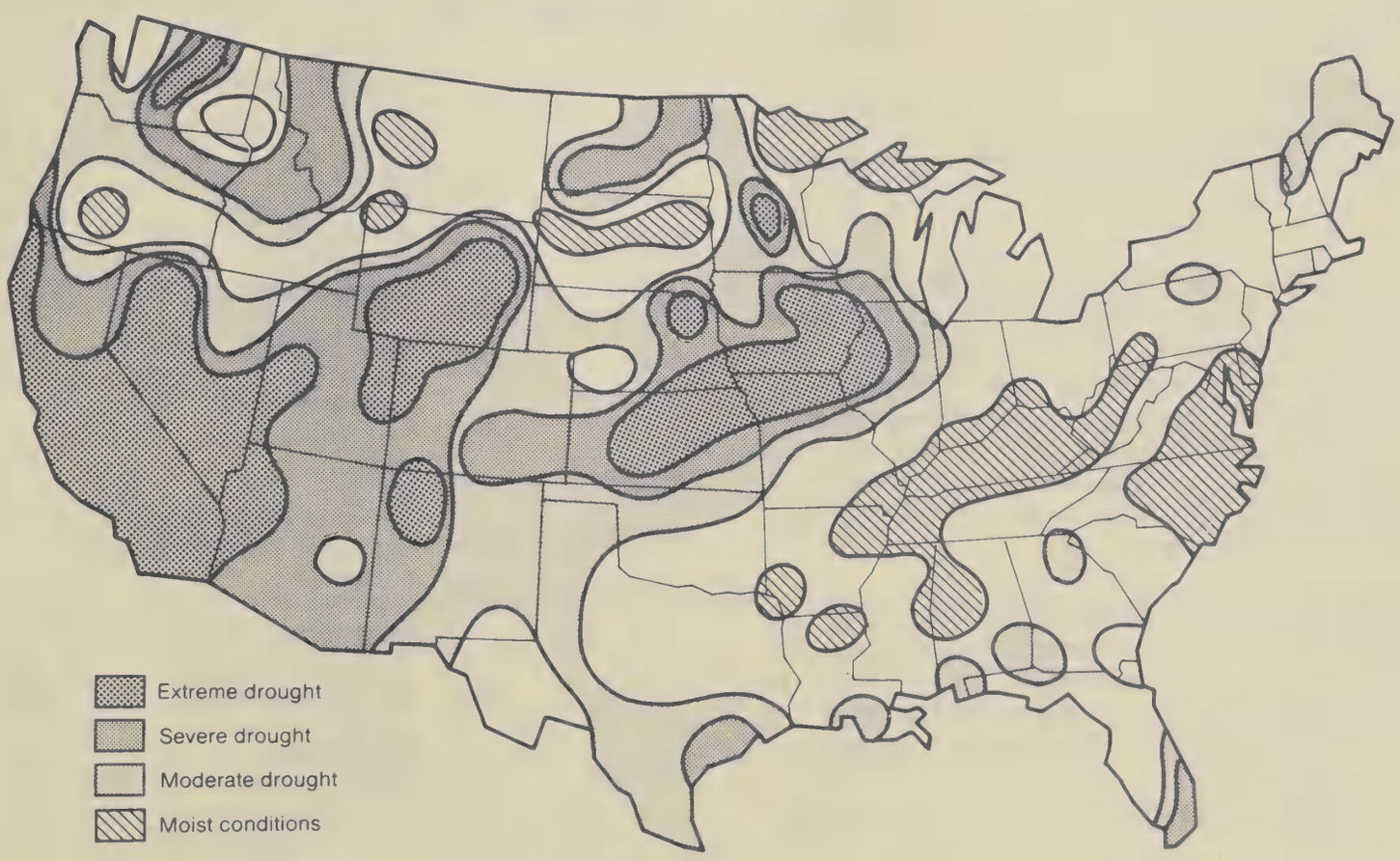
Reductions of up to 50 percent in surface water deliveries for irrigation in California were announced this spring. Reductions in water deliveries will result in substitution of more expensive ground water (where available), decreased yields in cash and forage crops, or reductions in irrigated acres. Impacts will be greatest on lower value forage crops, slight on field cash crops, and inconsequential on high-value and specialty crops. Actual impacts will vary by producer, depending on ground water availability, the availability of surface water from additional suppliers, and the ability to draw upon water stored for drought emergencies.

The impact of low reservoir levels goes beyond irrigation, affecting hydroelectric power generation and water releases for barge transportation and recreational uses. Areas of low reservoir levels and streamflow correspond to areas of increased demand for ground water, and thus, increased power demands for pumping it. Producers using electric-powered ground water pumping systems to substitute for lower priced surface water will pay higher fuel costs, as thermoelectric sources must substitute for lower priced hydroelectric power.

Barge traffic on the Missouri, and possibly the Mississippi, will be affected by below-normal reservoir levels in the Mis-

Figure 7

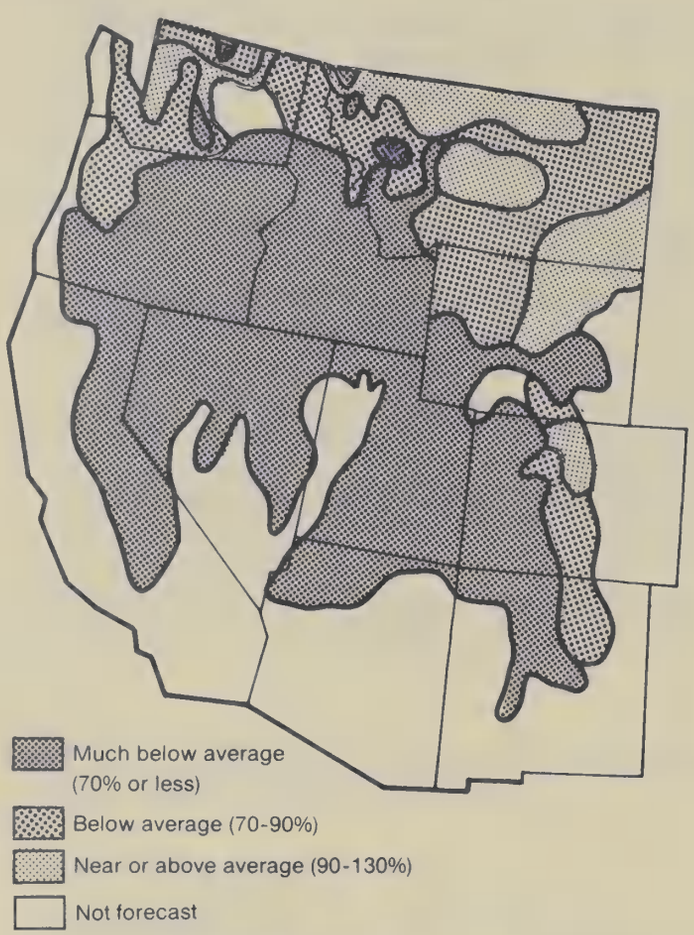
Palmer Drought Severity Index, May 6, 1989



Source: NOAA/USDA Joint Agricultural Weather Facility.

Figure 8

Spring and Summer Streamflow Forecast, May 1, 1990



Source: NOAA/USDA Water Supply Outlook.

souri River system. In Montana the five largest reservoirs were 20 percent below normal in May. (This is in contrast to Montana's smaller reservoirs for irrigation which were slightly above normal, as shown in fig. 9. The five large reservoirs holding water primarily for transportation have 20 times the storage of the irrigation reservoirs. The large mainstem reservoirs are not included in fig. 9.) Downstream, in the Dakotas, reservoir levels were also about 80 percent of the May 1 average.

Missouri and Mississippi River barges are used as a low-cost means to transport agricultural inputs (particularly fertilizer), outputs (primarily grain), and other bulk items. A disruption in barge traffic increases pressure on rail lines and other transportation alternatives. This problem could persist for several years, because above-average precipitation for an extended period will be required to bring water in storage to normal levels.

Ground Water Declines Slow in Plains

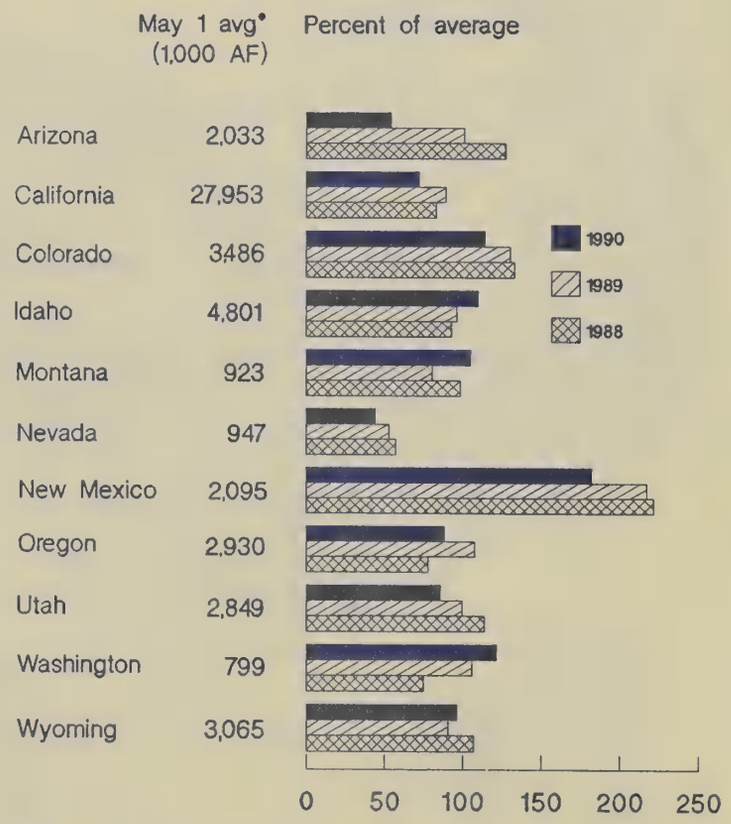
Ground water supplies about 60 percent of U.S. irrigated acreage, and is the source for most rural domestic and livestock uses. Ground water supplies for irrigation generally come from deep aquifers that cannot be exhausted by one or even several dry years. But extended reduced rainfall and/or soil moisture conditions necessitate increased ground water pumping for irrigation and aquifer withdrawals, heightening irrigation costs and exacerbating aquifer declines.

One region with a history of ground water declines is the High Plains. This area's aquifer lies under parts of eight Plains States encompassing about 175,000 square miles.

An aquifer's thickness determines the quantity of water that may be withdrawn for irrigation and other uses. The High Plains Aquifer averages about 200 feet in thickness, but significant variation occurs. In north central Nebraska the aquifer is very thick (1,300 feet), but it is generally thinner toward the south and toward the edges. The aquifer area shown in fig. 10 includes some areas where the aquifer is so thin it cannot be tapped. With some 3.25 billion acre-feet of water in storage, the High Plains aquifer is an important regional resource.

Figure 9

Suface Water Storage Conditions for Western States, May 1, 1990

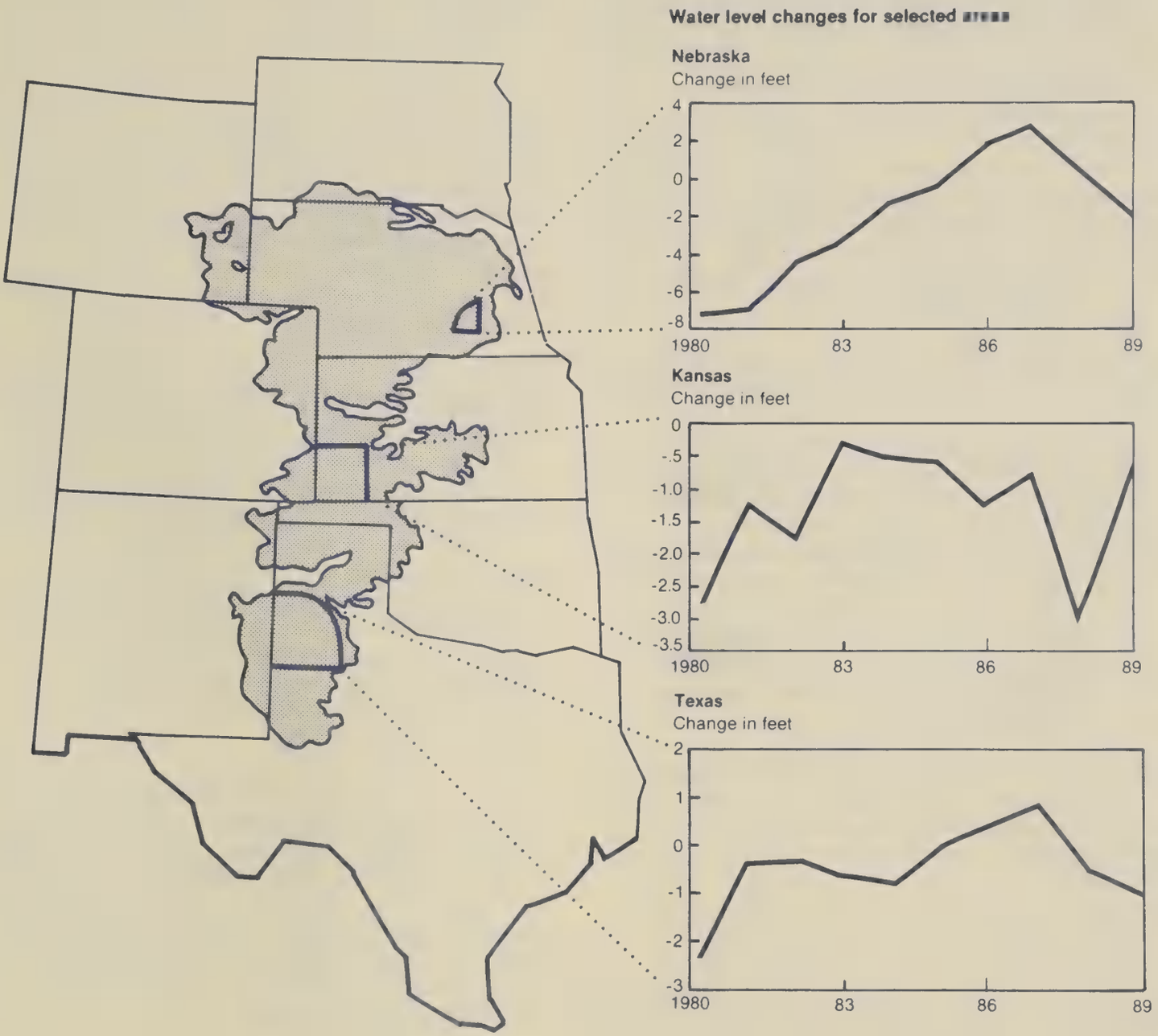


* Historic

Source: USDA/SCS Central Forecast System and California Department of Water Resources.

Figure 10

Location and Water Level Changes of the High Plains Aquifer



Source: U.S. Geological Survey; Upper Big Blue Natural Resources District, Nebraska; Southwest Kansas Groundwater Management District; and Texas High Plains Underground Water Conservation District No. 1.

Water level declines have occurred over most of the aquifer area from agricultural and other uses. Long-term declines have been greater in the southern part of the aquifer area, with a large area in the Texas panhandle declining more than 100 feet from predevelopment levels. Some areas, where the aquifer was initially thin, have exhausted their water supply.

In response to declining water levels, most States in the region have established ground water management districts to reduce ground water declines through education, training, and in some cases, limits on water withdrawals. Three of the areas monitoring ground water levels are the Upper Big Blue Natural Resources District (NRD) in Nebraska, the Southwestern Kansas Groundwater Management District (GMD) No. 3 in Kansas, and the High Plains Underground Water Conservation District (WCD) No. 1 in Texas.

The average annual change in water levels over the past decade for each of these three areas, and their approximate locations, are shown in fig. 10. In Nebraska, the Upper Big Blue NRD began the 1980's with an annual decline of 5.5 feet per year. The decline rates then slowed over most of the decade, reaching a 2-foot net recharge in 1987 before declining again. The Southwest Kansas GMD reports a more erratic decline path over the decade. At no time in the 1980's did the average ground water level increase in this area of Kansas. In Texas, the High Plains Underground WCD reported a rise in ground water levels for 2 years and decline of a foot or less in all other years, except 1980. These changes represent much slower decline rates than were experienced in previous periods.

Clearly ground water was mined in these areas during the 1980's, but at a lower rate than in past decades. Several factors contributed to the slowing in annual water level declines during the eighties. Many areas, particularly Texas and Nebraska, experienced above-average precipitation during the mid-1980's. High precipitation levels reduced the need to irrigate crops and increased the normally negligible recharge rate from precipitation. In the 1980's farmers were also under less pressure to pump ground water. Government programs with high annual set-aside requirements reduced acres irrigated. Relatively stable output prices reduced economic per-acre water application rates. The factor that probably had the greatest impact in slowing decline rates is the increasing awareness of the finite limits of the High Plains Aquifer. Agricultural producers are conserving water by improving the physical efficiency of water applications and management decisions about when and how much water to apply.

Water Supply Outlook

Adequate rainfall in much of the country from the Central and Southern Plains eastward through the Corn Belt to the Atlantic provided good initial season conditions for agriculture in 1990. Some areas received so much spring rain that crops were planted late; an early frost could reduce yields in areas of delayed planting. With adequate soil moisture, the June heat wave stressed crops in these areas but did not cause widespread crop failure.

The Far West is in a deepening drought. Restrictions on irrigation water supplies will limit lower value crop production in some California and Nevada areas this year. Below-normal summer streamflow is expected for most of the West, affecting the supply of water for irrigators who divert streamflow. This spring, water stored in reservoirs for irrigation purposes was lower compared to last spring in 7 of 11 States. Levels are critically low in California, Nevada, and Arizona. As indicated above, low reservoir levels will likely affect barge traffic and power output on the Missouri River system this year. As parts of the West endure the 3rd and 4th drought year, restrictions on water use will become commonplace in agriculture, municipal services, and other sectors.

The continued short-term pressures on the water storage and delivery system are rapidly becoming a longer run problem. It will take more than several years of "normal" precipitation to fill large reservoirs to near-normal levels. Thus, pressure for water conservation and structural adjustment will continue for the foreseeable future. (The special article on page 21 indicates that the effect of the drought has been somewhat mitigated in California because of that State's extensive water supply and delivery system.)

Table 9--Irrigated land in farms, 1978-90, by region

Region	1978 1/	1982 1/	1983 2/	1984 2/	1985 2/	1986 2/	1987 1/	1988 2/	1989 2/	1990 3/
	Million acres									
Northeast, Appalachian, & Southeast	2.9	2.7	2.8	3.0	3.1	3.0	3.0	3.1	3.3	3.4
Lake States & Corn Belt	1.4	1.7	1.5	1.9	2.1	2.0	2.0	2.3	2.3	2.2
Northern Plains	8.8	9.3	7.4	9.5	9.8	9.5	8.7	9.1	9.6	10.0
Delta States	2.7	3.1	2.9	3.4	3.6	3.4	3.7	4.4	4.3	4.6
Southern Plains	7.5	6.1	5.0	6.2	5.6	5.1	4.7	5.3	5.1	5.4
Mountain	14.8	14.1	13.3	14.1	13.5	13.6	13.3	13.9	14.3	14.1
Pacific	12.0	11.9	10.7	11.7	11.5	10.9	10.8	11.0	11.2	11.1
United States 4/	50.4	49.0	43.7	49.9	49.4	47.6	46.4	49.2	50.2	50.9

1/ Census of Agriculture. 2/ Estimates constructed from several unpublished USDA sources and Census of Agriculture. 3/ Preliminary estimates. 4/ Includes Alaska and Hawaii.

Irrigated Acreage Approaches Record

Farmers irrigated more land in 1990 than in any year since 1981. Ground water supplies were still adequate to maintain normal or near-normal irrigated acreage levels, despite the drought in the West. At 50.9 million acres, the 1990 estimated area is up 700,000 acres over 1989 and 4.5 million acres over that reported by the 1987 Census of Agriculture (table 9). This is still 1.2 million acres short of the 1981 record. Gains in irrigated area resulted from a reduction in the annual crop area set-aside requirements and continuing development of irrigation in Eastern States. Acreage increases would have been even greater with normal water supplies in the drought-stricken West.

Drought Affects California

Preliminary estimates for 1990 suggest that the Southwest drought, now in its 4th year, may have a substantial effect on irrigated land in farms. With lowered set-aside requirements for cotton, rice, and wheat, California's set-aside area this year is 195,000 acres lower than in 1989. Normally, this would result in an irrigation increase of similar acreage. However, preliminary estimates indicate that California farmers may have irrigated 200,000 acres less in 1990, suggesting that the impact of reduced water supplies is as high as 400,000 acres. More complete statistics will be available in coming months.

Irrigated acreage was up in all Eastern regions except the Corn Belt, where near-normal soil moisture has returned after the 1988 drought. Increases in the Southern Plains are likely related to the reduced set-asides, while increases in the Northern Plains reflect a long-term trend of continuing irrigation development.

In the West, declines are concentrated in California and other Southwest States. These declines appear modest, with the total area irrigated in Pacific and Southwest States only 200,000 acres lower than in 1989. However, the small net decline reflects (as in California) increases in crop acreage resulting from lower set-aside requirements, offset by larger declines in irrigated acreage attributable to reduced water supplies and other factors.

The 1988 Farm and Ranch Irrigation Survey (FRIS) is represented for the first time in the ERS estimates (table 10). The FRIS is a follow-on to the 1987 Census of Agriculture. That is, a statistical sample of farmers who had reported irrigation on their 1987 census returns were asked about their irrigation practices in 1988.

The data (after adjusting for exclusions) suggest that U.S. farmers irrigated almost 3 million acres more in 1988 than in 1987. Reductions in set-aside requirements for wheat, cotton, and rice, an increase in supplementary irrigation in response to widespread drought in the Central States, and continuing development of irrigation in the Northern Plains and humid States account for the increase. ERS estimates that farmers increased irrigation by an additional 1.7 million acres in 1989 and 1990.

Table 10--Irrigated area reported by the Farm and Ranch Irrigation Survey 1/

State	1984 2/	1988 3/	Change
	- 1,000 acres -		%
Arizona	893	840	- 6
California	7,805	7,562	- 3
Colorado	3,105	3,212	3
Idaho	3,255	3,124	- 4
Kansas	2,315	2,594	12
Montana	1,877	1,883	0
Nebraska	5,828	5,698	- 2
Nevada	698	576	-17
New Mexico	674	697	3
North Dakota	144	162	13
Oklahoma	440	489	11
Oregon	1,776	1,470	-17
South Dakota	339	363	7
Texas	4,921	4,450	-10
Utah	1,054	1,140	8
Washington	1,482	1,529	3
Wyoming	1,550	1,398	-10
17 Western States	38,157	37,189	- 3
31 Other States	6,574	9,010	37
Arkansas	1,872	2,755	47
Florida	1,438	1,460	2
Georgia	4/	646	
Illinois	4/	194	
Louisiana	579	675	17
Michigan	4/	314	
Minnesota	4/	324	
Mississippi	4/	756	
Missouri	4/	587	
Wisconsin	4/	272	
27 States	4/	45,181	
48 States	44,731	46,199	3

1/ Excludes horticultural and abnormal farms. 2/ Excludes farmers who did not irrigate in 1982. 3/ Excludes farmers who did not irrigate in 1987. 4/ Sample size insufficient for State estimates.

Table 11--Participation in 1987 annual commodity programs 1/

Item	Corn	Sorghum	Barley	Wheat	Cotton
	Percent of crop area				
All farms:					
All practices	83	84	84	84	86
Irrigated area	89	89	67	84	85
Dryland area	82	83	86	84	87
Irrigated farms:					
All practices	89	90	73	87	87
Irrigated area	89	89	67	84	85
Dryland area	88	91	83	88	90
Non-irrigated farms:					
Dryland area	82	81	87	84	86

1/ Percent participation in any annual program, weighted by area.

Note: definition is not the same as for rates reported by ASCS.

Source: 1987 Census of Agriculture, special summaries.

Irrigation and Program Participation

Compared to dryland, irrigated cropland tends to be equally represented in Federal commodity programs. In aggregate, annual changes in irrigated area are related to annual changes in program set-asides. The effect of set-asides is roughly proportional, with changes in irrigated area averaging 10 to 13 percent of the changes in set-aside area.

Looking across program crops in 1987, only barley shows a significant difference between participation rates of irrigated and dryland acreage (table 11). Approximately 86 percent of dryland barley, but only two-thirds of irrigated barley, was harvested from farms participating in one or more annual programs in 1987. Irrigated farms harvesting corn and sorghum were slightly more likely to participate than nonirrigated farms. On irrigated farms producing wheat and cotton, the irrigated crop area was slightly less likely to be on a participating farm. The remaining major irrigated program crop is rice which is 100 percent irrigated.

Irrigation Outlook

Short-term fluctuations in irrigated acreage will continue to be driven primarily by annual cropland set-aside programs. However, statistics for 1990 demonstrate that weather can be a major regional factor. In the Corn Belt and neighboring States where soil moisture has recovered from the 1988 drought, supplemental irrigation has already fallen back to more normal levels and the development trend should re-emerge.

The situation could be much different in the Southwest, where prolonged drought has the opposite effect on area irrigated. After 4 years of drought, much of the buffer against another year of below-average streamflows has disappeared. If the drought continues, the effect on irrigation seen in 1990 will be the beginning of a long-term decline in irrigated area and/or major improvements in water use efficiency. A return to normal precipitation patterns would not necessarily result in increased availability of water to farmers, since municipal use is growing rapidly, reservoirs must be refilled, and there is increasing awareness of minimum streamflow requirements. In the Northwest, irrigated area has remained stable near the levels of the late 1970's.

With the continuing development of irrigation in the Northern Plains and Eastern States possibly offset by further constraints on irrigation in the Southwest and by increased wheat set-asides, irrigated area in 1991 will be unchanged at about 51 million acres. Beyond 1991, an elimination of the remaining 25 million acres idled under annual programs could increase irrigation by 2 to 3 million acres above current levels. Development will add another million acres every 3 years. The big uncertainty is, of course, the persistence of the Southwest drought pattern.

California Water System Reduces Drought Impact

by

Mark Kramer and Noel Gollehon[1]

Abstract: Surface water deliveries to agricultural users in California by State and Federal water agencies were reduced by as much as 50 percent this year due to 4 years of drought. Nevertheless, statewide production of most crops is expected to be relatively unaffected. Many producers will experience net return reductions because of higher water costs, but major losses will be concentrated in areas without alternative water supply options. The distribution of the drought's impact is affected by State water law and the nature of water delivery contracts. Institutional change may be an important part of long-run solutions to California's water supply problems.

Keywords: California, drought, irrigated agriculture

Despite cutbacks of up to 50 percent in surface water for irrigation in California this year, production impacts are expected to be limited in most irrigated areas of the state. A flexible water supply system and a sophisticated water storage and delivery infrastructure unique to California have helped mitigate the effect of a 4-year drought. Minor reductions in net returns are expected to be widespread, with large negative impacts in some areas. Nevertheless, California is experiencing less impact on production and net return than would be the case without the extensive irrigation infrastructure.

Ultimately, however, the surface water supply depends on precipitation, and not even the most sophisticated delivery system in the world can generate rain or snow. Four consecutive drought years—with precipitation reaching only 70, 75, 85 and 60 percent of the 30-year average—have drained California's reservoirs, resulting in imposition of water delivery restrictions.

The current restrictions pale in comparison with the probable consequences of another drought year in 1991. If precipitation is much below normal for a 5th consecutive year, the quantity of surface water delivered for irrigation would likely be cut by 75 percent from normal levels. Both production levels and net returns would be significantly reduced.

During the current crop year, the degree of water shortfall varies with area and type of use. The Bureau of Reclamation (USBR) and the California State Water Project (SWP) have both reduced the quantity of water supplied to most agricultural users by 50 percent. There are notable exceptions.

Some older irrigation districts located along the San Joaquin and Sacramento Rivers will receive their full allocation, which accounts for about 20 percent of the surface water delivered for irrigation by the USBR in an average year. Most municipal and industrial users served by the USBR face 20- to 25-percent reductions in surface water deliveries, while some have had their deliveries reduced by as much as 50 percent.

The SWP has not yet imposed restrictions on deliveries to municipal and industrial users. If the SWP were to cut deliveries to agricultural users by more than 50 percent, SWP policy would require that deliveries to municipal and industrial users also be cut. A 75-percent reduction in agricultural deliveries, for example, would trigger a 25-percent reduction in deliveries to other users.

Ground Water Substituted For Surface Water

The agricultural sector appears to be responding to the reduction in surface water supply primarily by using more ground water. Reduction in irrigated acreage is expected to be small relative to the 50-percent surface water cutback, reaching at most 400,000 acres—about 5 percent of the acreage irrigated statewide in 1988. Consequences of the drought will be most severe for the production of "lower valued" crops such as forage. It is anticipated that lower irrigation water application rates and some fallowing will result in reduced production of forage crops, irrigated hay, and pasture.

Net return impacts are expected to be widespread, as many irrigators will find it necessary to switch from surface water to more expensive ground water. In areas where ground water is unavailable the impact on net returns will be severe.

Among agricultural producers the greatest impacts will likely be felt by livestock producers, who face shortages of forage for summer grazing and higher hay prices from reduced irrigated production. The effect on the agricultural

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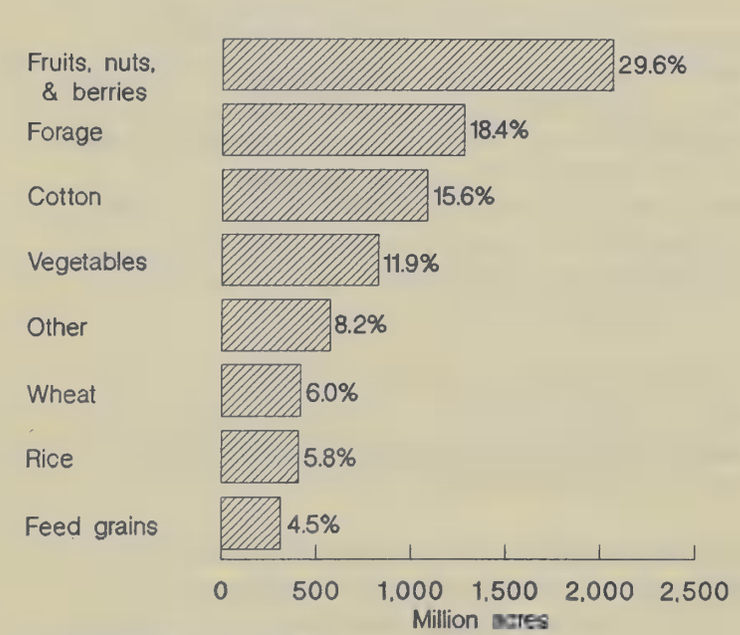
sector as a whole will not be negligible, as livestock production is an important agricultural enterprise in California. In 1989, the total value of agricultural products sold from farms in the State was $17.3 billion. Of this, sales from dairy and beef cattle farms accounted for $3.94 billion, exceeding the $3.93 billion in sales of vegetables, and the $3.19 billion in sales of all field and seed crops combined.

Major Crops Relatively Unaffected

The cultivation of rice involves a greater per-acre use of water than any other crop grown in the State. Despite this, statewide rice production appears to have been only slightly affected by the drought. Rice is grown primarily in the Sacramento Valley within irrigation districts that have received their full allocations. In 1987, rice accounted for about 6 percent of irrigated cropland in California (fig. A-1). In 1990, acreage is estimated to be down 5 to 10 percent statewide from last year (in addition to the 20 percent of rice acreage set aside in compliance with Federal commodity program requirements). Some rice farmers in these districts heeded early warnings of possible water cutbacks and missed their planting dates. Most producers who did plant rice have adequate water to maintain normal application rates.

The cotton crop is expected to be relatively unscathed this year, due to availability of ground water and cooperative water exchanges between farmers and districts in the cotton-growing region of the southern San Joaquin Valley. Due to failed wells or exhausted surface water allocations, however, some growers will be unable to apply a final irrigation this season. These growers will feel the impact of the drought in the form of reduced yields. Some private analysts expect that the blow will be softened by upward pressure on market prices for cotton lint in the current tight stock situation. The prospect for next year's crop is more ominous, with many more growers likely affected. Most will have little, if any, water available for pre-irrigation in preparation for spring cotton planting. A reduction in cotton acreage—possibly quite large—is almost inevitable next year if the significant precipitation shortfall persists through another winter.

Figure A-1
California Crops: Acreage and Percent of Irrigated Cropland



Source: 1987 Census of Agriculture

Statewide production impacts on "high-valued" crops—fruits, nuts, and vegetables—are expected to be minimal, though local impacts may be severe. A few USBR-served districts with especially low per-acre allocations may qualify for additional water under the USBR's "hardship criterion." This allows for delivery of water above the 50-percent drought-year allocation, to keep perennial crops, excluding pasture, alive. This water is intended solely for the survival of the tree or vine and is considered insufficient for the production of a harvestable crop. Effects of drought stress on yield may persist for one or more years following the end of the drought.

Despite the relatively high value of vegetable crops, some reduction in vegetable acreage may occur in the San Joaquin Valley this year. Vegetables in this region are normally grown as a second crop, planted in the late summer or early fall, after a summer crop such as tomatoes, melons, or cotton has been harvested. Many growers will have used their entire allocation to irrigate the summer crop and will have nothing left with which to irrigate vegetables, unless additional water supplies can be found. Despite local impacts, statewide production of fruits and vegetables is expected to be close to normal.

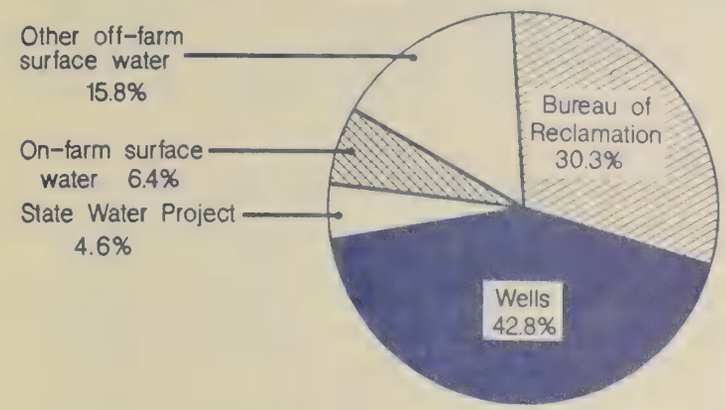
Alternative Sources Provide Flexibility

California producers in 1988 irrigated over 7.5 million acres[2]—about 80 percent of the active cropland—with 23.3 million acre-feet (MAF) of water. Alternative water sources and their relative contribution to the total agricultural water supply in 1988 were: ground water, 43 percent; surface water from on-farm sources, ponds and streams, 6 percent; and surface water from off-farm sources (primarily irrigation districts), 51 percent (fig. A-2).

About 40 percent of the irrigated acreage, concentrated on 14 percent of the farms, had access to more than one water source (figs A-3, A-4). Multiple access provides producers with water-source flexibility. In years of surface water shortages, for example, more expensive ground water may be used on acres that normally receive surface water.

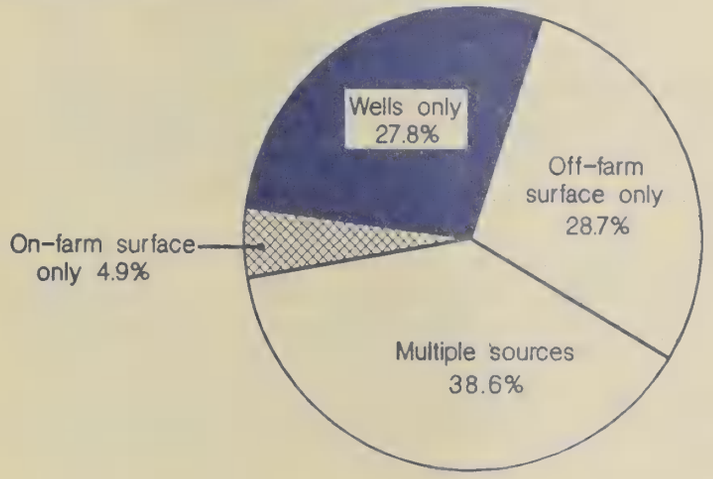
[2] This estimate of irrigated acreage from the 1988 Farm and Ranch Irrigation Survey excludes institutional farms, experimental and research farms, Indian reservations, and horticultural specialty farms.

Figure A-2
Irrigation Water in California: Major Sources and Suppliers, 1988



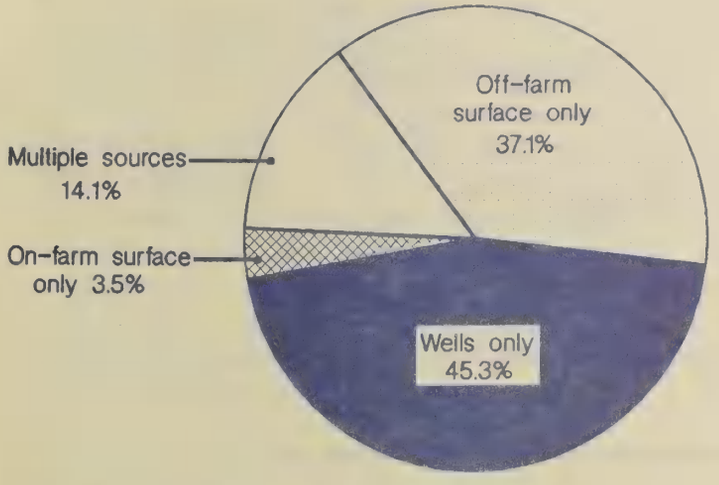
Sources: 1988 Farm and Ranch Irrigation Survey; California Department of Water Resources; 1988 USBR Summary Statistics: Water, Land, and Related Data.

Figure A-3
Irrigated Acreage in California: Major Water Sources, 1988



Source: 1988 Farm and Ranch Irrigation Survey.

Figure A-4
Irrigated Farms in California: Major Water Sources, 1988



Source: 1988 Farm and Ranch Irrigation Survey.

Many of the farms with access to more than one water source are located within the Friant Unit of the USBR's Central Valley Project (CVP). The Friant Unit was designed to provide USBR surface water to supplement local ground water supplies. The average size of farms in the Friant Unit service area is estimated to be only about half of the 1988 statewide average of about 142 irrigated acres per irrigated farm (3). Despite this, in California as a whole, the average farm with access to more than one water source irrigates 45 percent more acreage than does the average irrigated farm (5). Farms with access to more than one source are better able to cope with the surface water delivery cuts than their single-source counterparts.

More than half of the irrigated farms in California use surface water purchased from off-farm sources, but only 37 percent, farming 29 percent of the irrigated acreage, are totally dependent upon this irrigation water source (fig. A-4). The average farming operation that is totally dependent upon off-farm surface water is smaller in land area, at about 125 acres, than the average irrigated farm in the state (5). These farms are likely to experience the greatest negative impact of the reduction in surface water deliveries.

The largest share of off-farm water—about 30 percent of the total water used by agriculture in California—was supplied by USBR in 1988. Individual irrigation districts, tapping their own surface water sources, provided about 16 percent of the total water used by irrigators, while the SWP supplied about 5 percent (fig. A-2). The USBR and SWP serve also as water suppliers to municipal and industrial water users, providing about 2.8 MAF to urban and rural water systems in 1988.

Irrigated acreage in California is served with water from both the California and Lower Colorado hydrologic regions. Water users—municipal, industrial, and agricultural—in the California basin store water in 148 reservoirs with a total storage capacity of 34.5 MAF. Together the USBR and the SWP link these reservoirs to each other and to downstream users with 87 pumping plants and 2,500 miles of aqueducts, pipelines, and tunnels (fig. A-5). This system has made possible full deliveries to almost all surface water users during the previous three drought years.

Water from the Lower Colorado River Basin irrigates desert lands in the Imperial and Coachella Valleys of southern California. Colorado River water also constitutes an important portion of the supply for the Metropolitan Water District, the main provider for urban users in southern California. These users draw water from the massive Colorado River reservoir system with a storage capacity of 53.6 MAF, equivalent to four times the average annual flow of the river. Water is diverted from the Colorado River and conveyed to urban and agricultural areas through three major pumping plants and 420 miles of aqueducts, pipelines, and tunnels.

Figure A-5

Major California Surface Water Supply and Conveyance Facilities

Source: California Department of Water Resources.

So far, the severe surface water delivery reductions are confined to the Central Valley (Sacramento and San Joaquin Valleys). The negative effects of the drought have not been felt by surface water recipients in the extreme southern part of the state. Irrigation districts in the Imperial and Coachella Valleys, comprising 8 percent of the State's irrigated acreage, have received their full allocations this year.

The Salinas Valley is one of the major vegetable-producing regions in the State. The valley is served by neither the USBR nor the SWP, and so is unaffected by cuts in surface water deliveries. The area has not, however, escaped the effects of the continuing drought. Water used for irrigation in the Salinas Valley is almost exclusively ground water, and drastic reductions in the recharge rate due to the drought have resulted in serious overdraft of the aquifer. Lowering of the water table in such proximity to the Pacific Ocean has caused concern over contamination of the aquifer through saltwater intrusion.

Water Rights Affect Pattern Of Drought Impact

Water rights in California, and throughout the West, are based primarily on the "prior appropriation doctrine," which can be summarized by the phrase "First in time, first in right." The doctrine holds that a right is established from the date of earliest diversion, for the quantity which is put to "beneficial use." Historically, diversions for irrigation and municipal and industrial use have been considered beneficial, while conservation and instream flow have not.

As a consequence of the nature of water rights in California, the impact of the drought has not been felt equally by all surface water users. Members of the Sacramento River Water Contractors Association (SRWCA), for example, have received their full allocation. These districts and individuals have water rights that predate the development of the Federal or State water delivery infrastructure. The water service contracts these districts subsequently negotiated with the USBR reflect this priority.

Members of SRWCA receive a base supply—an estimate of the quantity of water they reliably diverted prior to construction of USBR facilities—at no charge. In addition to the base supply, they contract to pay for delivery of some "project water," which is water considered to have been made available by the USBR's construction of storage facilities and seasonal control of the river's flow. The contracts contain provisions stipulating that the districts are to receive their full allocation except in cases of extremely low river flow conditions. It had been expected that these districts would be subject to a 25-percent reduction in their 1990 water allocation. This contingency was narrowly averted when late spring rains pushed the cumulative runoff just over the contractual threshold, obligating the USBR to provide the districts their full allocation.

Some older districts along the San Joaquin River have signed "exchange contracts" with the USBR. These allow the USBR to divert, at a point upstream, water that would normally have flowed to the districts. The water is delivered to districts in the southern San Joaquin Valley via the Friant-Kern and Madera Canals. In exchange for the San Joaquin River water foregone, the USBR delivers to the districts water from CVP facilities in northern California. This replacement water arrives via the Sacramento River, the Sacramento-San Joaquin River delta, and the Delta-Mendota Canal. These exchange contracts contain provisions similar to those included in the water service contracts signed by the older districts along the Sacramento River. When unusually heavy late-season rains pushed the annual cumulative runoff into Lake Shasta to just over 3.2 million acre-feet, these districts were likewise assured of receiving their full allocation this year.

Irrigation districts located along the lower Feather River in northern California retain rights that predate the construction of massive Oroville Dam, the key storage component of the State Water Project. These districts lie along the river, below the dam and above the confluence with the Sacramento River. The State is releasing sufficient water from Oroville Dam to fully satisfy the water rights held by these districts.

With the exception of the special cases mentioned above, recipients of State or Federal water do not hold their own water rights. Both the USBR and the SWP acquired rights, in accordance with the laws of the State of California, to much of the water they now deliver. Officially, the USBR and the SWP hold these rights as trustees for the irrigation districts and landholders that put the water to beneficial use. Individual irrigation districts sign contracts to receive water to which the USBR or SWP retains the rights. These irrigation districts are operating under a severe curtailment in surface water deliveries this year.

Water Can Move to Dry Areas

In times of drought, water tends to move from have to have-not areas. Even if users in a drought area can find water supplies available for purchase, the water may be hundreds of miles away. Water may be moved, or "wheeled," through the canal and reservoir system to serve distant areas. Water wheeling means that, as the water being transferred enters one system, the same quantity (adjusted for losses) is released to the next system. Although the drought area receives the proper amount of water, it is not physically the same water that was purchased: That water was used far upstream, or on a different canal system. The water actually received comes from a nearby source, and that source is then owed water from upstream or up-canal.

Both the USBR and the SWP allow water to be wheeled through their pumping plants and aqueduct systems

(fig. A-5). Water transfers involving USBR water or infrastructure are subject to USBR policy, and therefore may not result in a profit to the supplying district. Sellers are allowed to charge a sufficient amount to cover additional costs incurred as a result of the transaction.

As of mid-summer this year, the USBR had approved transfers of only about 15,000 acre-feet of surface water stored in its reservoirs—all among users located within the Friant Unit of the CVP. In early August, the USBR approved the transfer of 40,000 acre-feet of stored surface water out of the SRWCA project water pool. The USBR, citing the need to reserve water for maintenance of wildlife habitat and to prepare for possible continuation of the drought into next year, is approving transfers of currently stored Federal water only if the district seeking the water meets the "hardship criterion." As of late July, no transfers of water from users in the Sacramento Valley to agricultural users in the San Joaquin Valley had been approved. Petitions for additional transfers are pending, however, and some late-season movement of water may occur.

Additional transfer activity—accounting for most of the water movement in the state—involves non-USBR water. Much of the activity is occurring over relatively short distances, under the auspices of regional water management agencies. These water agencies coordinate the efforts of member districts to respond to the drought. Some irrigation districts in the Central Valley are pumping ground water for their own use and making their surface water allocations available for purchase by other districts. Others are pumping ground water for transfer to nearby districts in exchange for future surface water allocations, which will be used to recharge the aquifer. These exchanges are facilitated by organizations such as the Kern County Water Agency, among whose 16 member districts 100,000 acre-feet of SWP water and ground water had been redistributed by early summer. Such transfers help minimize the production impacts of the drought.

The impact of such transfers on net returns may be large, however, as the cost of irrigation water acquired through exchange can be significantly higher than that of surface water in a normal year. There are two main reasons for the increase in the cost of water.

First, the annual operation and maintenance costs for the USBR and the SWP do not vary significantly with the quantity of water delivered. Therefore, when deliveries are halved, total cost remains approximately the same as for full deliveries, and the average per-unit cost of water doubles. The price that districts are paying to the USBR or to the SWP this year is about twice what it was last year. Similar logic applies to maintenance and operation of district infrastructure; the district's costs per unit of water increase as well.

Second, while ground water is free to anyone who can pump it, the equipment and energy required to lift it can be quite costly. Prices paid by farmers per unit of water are reported to be anywhere from 25 to 100 percent higher this year than last. The magnitude of the water cost increase varies widely across the State, depending upon the particular circumstances of each district.

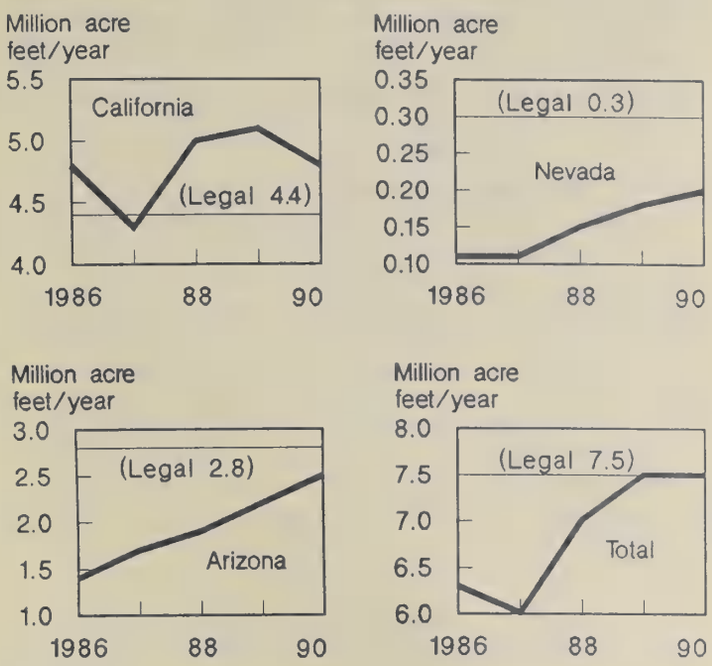
The substitution of ground water for surface water is by no means indefinitely sustainable. The Kern County Water Agency estimates that the rate of ground water overdraft within its service area will increase dramatically, from a low of 100,000 acre-feet last year up to about 1 million acre-feet this year. The Friant Water Users Authority (FWUA) estimates the current rate of ground water mining within its jurisdiction at 1 to 1.5 MAF per year. The aquifer underlying the FWUA is estimated to hold 20 MAF, but the economically retrievable quantity is somewhat less than that. As the depth to water increases, so do the costs of extraction. In other parts of the State, wells are drying up, as local water tables are rapidly lowered by intensive pumping activity.

Institutional Adjustments May Be Needed

Factors other than drought have exacerbated the problem. The West in general is facing increasing demand for water supplies, both to meet the claims of all diverting users and for maintenance of instream flow. Historically, California has used more than its allotted share of Colorado River water, which was possible as long as other States failed to use their entire allotments (fig. A-6). As the Central Arizona Project nears completion, Arizona is capturing more of its share, resulting in reduced diversions for California. Increased instream flow levels necessary for maintenance of environmental quality translate into reduced diversions by Los Angeles from Mono Lake and the Owens Valley, and release of water into the Sacramento-San Joaquin River delta to improve water quality and protect fish and wildlife habitats.

Long-term solutions to California's (and the West's) water problems will involve institutional adjustments and conservation. Despite the impressive ability of California's water delivery system to minimize the impacts of drought on the agricultural sector, improvements are possible. Currently, significant institutional barriers inhibit the transfer of water between users throughout the West. Users with an abundance of water are often prevented from transferring water to others for whom the value is higher. Incentives for holders of water rights to invest in water-conserving technologies could be increased if the "use it or lose it" nature of appropriative water rights were modified. Legislative changes in USBR policy and Western water law could facilitate transfers and reward users for water conservation. Such changes could result in a significant increase in the efficiency of water resource allocation.

Figure A-6
Legal and Actual Lower Colorado River Water Consumption



1990 projected.
Source: U.S. Water News, June 1990.

In California, the legislature has attempted to implement some of these changes. Largely as a consequence of the State's last major drought, California water code was altered in 1979 to include language defining conservation as a beneficial use. The Costa-Isenberg Water Transfer Act of 1986 affirmed State policy to encourage water transfers, subject to compliance with State law on environmental and other third-party effects. Another law passed that year requires that State and local agencies make unused conveyance capacity available to other districts or individuals wishing to conduct approved transfers. In addition, State law does not prohibit suppliers of water from making a profit on sales.

In light of these efforts to remove legal barriers, one might expect more transfer activity than has actually been observed. One possible reason activity has not accelerated is that rights to a significant proportion of surface water delivered for irrigation in California are held by a single entity, the USBR. Changes in State law may have little impact on transfers between USBR contractors, as these will still be subject to Federal law governing USBR policy.

In addition, all transfers involving a change in the location or type of use specified in a water right must be approved by the State Water Resources Control Board (SWRCB). The SWRCB provides opportunity for public comment and considers potential third-party effects of proposed transfers. A third-party effect is the impact of a transaction upon persons or entities not directly involved in the transaction. Reductions in water available for downstream diversions, lost opportunities for hydroelectric power generation, unmet recreation flow needs, and adverse impacts on fisheries of changes in water temperature and timing of flow, are all examples of third-party effects that could be caused by water transfers. Formal protests, based on real or perceived third-party effects, have been sufficient to convince the SWRCB to block or delay many proposed transfers.

Difficult times call for innovative solutions. For example, additional Colorado River water will be going to the Metropolitan Water District from agricultural users in the Imperial and Coachella Valleys—a transfer made possible by conservation measures financed by the Metropolitan Water District. While regulation is necessary to mitigate environmental and regional economic impacts, more cooperation of this sort among users is needed to encourage conservation and to allow movement of water from lower to higher value uses.

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Fiscal year 1990 has seen the initiation of USDA activities to strengthen efforts that address agricultural water quality and conservation concerns. The President's Water Quality Initiative, aimed primarily at protecting the Nation's drinking water, called for new actions to reduce potential contamination and pollution from agricultural pesticides and fertilizers.

Ongoing USDA conservation programs and further implementation of the 1985 Food Security Act continue to benefit soil conservation and water quality. The Conservation Reserve Program, "Sodbuster," "Swampbuster," and conservation compliance provisions of the act, along with other continuing USDA conservation programs, offer farmers and ranchers incentives to reduce potential degradation of our Nation's soil and water resources.

The President's Water Quality Initiative

The President's Water Quality Initiative is a multiagency program to assess water quality problems and to develop means for preventing or reducing degradation of the Nation's surface and ground water resources. USDA and other Federal agencies provide farmers, ranchers, and foresters with information, education, and technical and financial assistance to address on-farm environmental concerns and State water quality requirements. A principal emphasis of the initiative is ground water protection, particularly protection from nitrogen fertilizer, pesticides, and animal waste. Since water quality problems related to the use of agricultural chemicals tend to be localized, national policies and programs stress the importance of joint, cooperative efforts with State and local governments.

USDA activities in support of the initiative fall into three components: research and development, data and evaluation, and education and technical assistance.

Research and Development Aimed at Improving Farming Practices

The goals of the research and development component of the President's initiative include: 1) research on the physical processes by which agricultural chemicals affect the environment and on human and environmental factors that influence these processes, 2) evaluation and development of new farming systems that reduce the impact of agricultural chemicals, 3) development of management systems and decision aids to help farmers apply the new farming systems, and 4) research on the impact of agrichemicals and farming practices on the ecosystem. These goals will be met over the next 5 years through cooperative efforts of the USDA agencies, U.S. Geological Survey, Environmental Protection Agency, and States.

On-farm research sites have been selected in the Midwest as part of the cooperative effort between USDA agencies and the U.S. Geological Survey to conduct research on the movement of agricultural chemicals into water bodies and the effectiveness of management practices in preventing degradation. Plans call for on-site experiments to begin in 1990 on the first five sites.

Data and Evaluation Activities to Support Policy and Farm Decisions on Chemical Use

Under the data and evaluation component of the initiative, the USDA will survey farmers to collect information on current chemical use and related farm practices. State estimates will be made of pesticide products and fertilizer nutrients applied to major field crops, fruits, and vegetables. The Economic Research Service will assess the environmental effects of alternative management systems on water quality and evaluate the economic impact of adopting the new farming systems.

A 1989 survey of cotton producers collected data on fertilizer and pesticide use on cotton, and obtained information on management practices and other farm characteristics. Survey efforts are underway in 1990 for other major field crops and vegetables. These surveys will support in-depth economic analysis of farm decisions regarding the use of agricultural chemicals and the potential for degradation of ground and surface waters.

Education and Technical Assistance to Facilitate Improved Practices

The education and technical assistance component involves special projects to promote the adoption of sound management practices. Existing USDA programs offered by the Extension Service (ES), the Soil Conservation Service (SCS), and the Agricultural Stabilization and Conservation Service (ASCS) are being expanded in specific localities. Special cost sharing for approved practices will be made available in areas identified with nonpoint-source water pollution problems and with needs for water quality protection and enhancement. These projects will demonstrate how water quality can be protected through careful farm management while maintaining profitability.

Demonstration projects have been selected in eight States: California, Florida, Maryland, Minnesota, Nebraska, North Carolina, Texas, and Wisconsin. An additional 16 demonstration projects will be selected over the next 2 years. Funding for education and technical assistance for the initial eight projects was authorized this year. ASCS will make some funds available for cost sharing of installed practices.

Education and technical assistance projects to promote water quality have also been developed for 37 watersheds with nonpoint-source pollution problems. The watersheds were chosen from areas identified by the States in response to section

319 of the Water Quality Act of 1987. Additional watersheds will be targeted for assistance over the next 5 years. The USDA has been authorized to spend $17 million to help States develop programs to reduce agriculture-related water quality problems in these watersheds.

The Agricultural Stabilization and Conservation Service awards special cost-sharing funds and has established special projects to help farmers institute the best management practices to protect water quality. ASCS had budgeted an increase in water- quality-related expenditures, rising from $18.8 million in 1989, to a requested $40.2 million in fiscal year 1991.

1985 Law Provides Resource Protection

The conservation provisions of the 1985 Food Security Act authorize placement of 40 to 45 million acres of highly erodible or environmentally sensitive cropland into a conservation reserve. Protection is also provided for highly erodible land, as well as wetlands with potential for conversion to cropland. In addition, highly erodible cropland not enrolled in the conservation reserve is subject to a compliance requirement.

CRP Enrollment Holding at Almost 34 Million Acres

A total of 33.9 million acres from 333,000 contracts has been enrolled in the Conservation Reserve Program (fig. 11, table 12). Farmers enrolled this acreage during nine separate signup periods from March 1986 to August 1989. No signup opportunities were offered in 1990. The USDA plans to postpone additional signups at least until deliberations on the 1990 farm bill are complete. The deliberations could result in modification of the CRP including an extension of the current enrollment deadline (see section on farm bill conservation proposals). If the 1990 farm bill contains no modifications, USDA would have until October 1, 1991 (the end of the 1990 crop year) to enroll at least 6.1 million additional acres.

In exchange for retiring highly erodible and/or environmentally sensitive cropland for 10 years, the USDA pays participating farmers an annual per-acre rent and one-half of the cost of establishing vegetative land cover (usually grass or

Figure 11

CRP Enrollment Approaches Mandate of 40-45 Million Acres

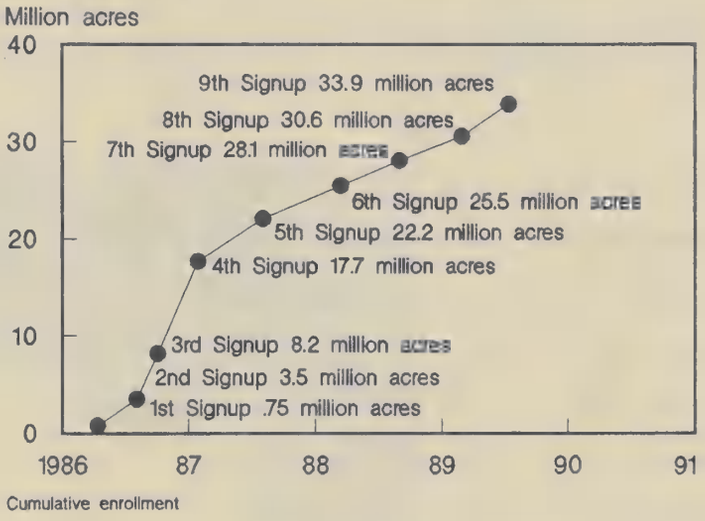


Table 12--Enrollment in the Conservation Reserve Program

Item	Number of contracts	Number of acres	Average rental rate	Average erosion reduction
	1,000	Million	$/acre/year	Tons/acre/year
Signup period:				
#1 March 1986 1/	9.4	0.75	42.06	26
#2 May 1986	21.5	2.77	44.05	27
#3 August 1986 2/	34.0	4.70	46.96	25
#4 February 1987 3/	88.0	9.48	51.19	19
#5 July 1987	43.7	4.44	48.03	17
#6 February 1988 4/	42.7	3.38	47.90	18
#7 July 1988	30.4	2.60	49.71	17
#8 February 1989 5/	28.8	2.46	51.04	14
#9 July-August, 1989	34.8	3.33	50.99	14
Total	333.4	33.92	48.93	19
Cumulative enrollment by fiscal year:				
1986	21.0	2.04	43.11	28
1987	145.9	15.71	49.15	23
1988	233.5	24.47	48.52	21
1989	295.4	29.82	48.78	20
1990 /6	333.4	33.92	48.93	19

1/ Eligible acres included cropland in land capability classes II through V eroding at least three times greater than the tolerance rate (see definitions), or any cropland in land capability classes VI through VIII. 2/ Eligible acres expanded to include cropland in land capability classes II through V eroding at least two times the tolerance rate and having gully erosion. 3/ Eligible acres expanded to include cropland eroding above the tolerance rate with an erodibility index of 8 or greater. 4/ Eligible acres expanded to include cropland in land capability classes II through V eroding at least two times the tolerance rate if planted in trees. Eligibility also extended to cropland areas 66 to 99 feet wide adjacent to permanent water bodies for placement in filter strips. 5/ Eligible acres expanded to include cropped wetlands and cropland areas subject to scour erosion. 6/ Actual number of contracts, acres enrolled, rental rates, and erosion reduction are not final pending future signups.

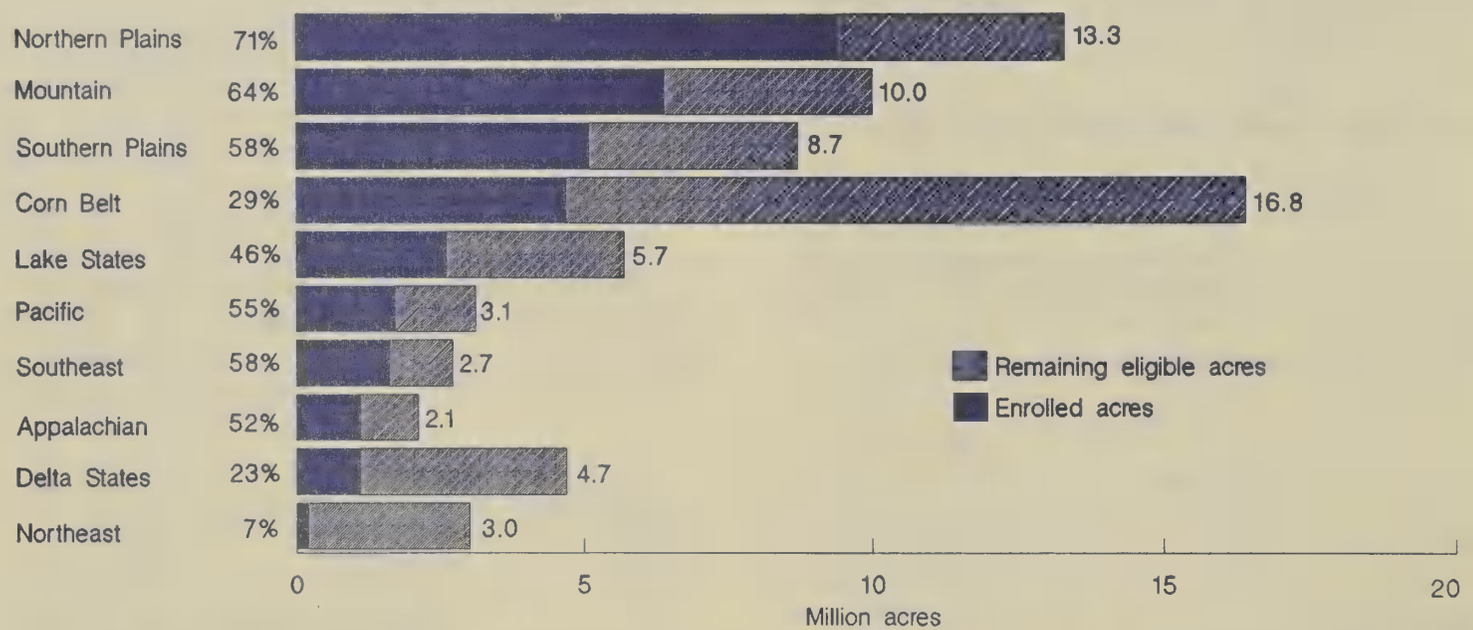
trees). The primary goal of the CRP is to reduce soil erosion on highly erodible cropland. Secondary objectives include protecting the Nation's longrun capability to produce food and fiber, reducing sedimentation, improving water quality, providing wildlife habitat, curbing production of surplus commodities, and providing income support for farmers.

Northern Plains dominates recent enrollment. Fully 44 percent (1.5 million acres) of enrollment in the ninth signup (July-August 1989) was in the Northern Plains region (North Dakota, South Dakota, Nebraska, and Kansas). Overall this region accounts for 28 percent of CRP enrollment (table 13). The Mountain region accounts for 19 percent of enrollment while the Southern Plains and Corn Belt account for 15 and 14 percent (figs. 12, 13).

Erosion reductions are impressive. Erosion reduction from all CRP enrollment is currently estimated at 655 million tons per year, approximately 21 percent of the erosion generated by all cropland prior to the program. For the initial signups in 1986, erosion reductions averaged 25-27 tons/acre/year. By the ninth signup, annual soil erosion reduction had decreased to 14 tons/acre/year. The overall erosion reduction on CRP land averages 19 tons/acre/year.

Rental payments average $48.93 per acre. Federal Government rental expenditures for all acreage now enrolled in the CRP will average about $1.7 billion annually through 1995. Government cost sharing for vegetative cover establishment averages $37 per acre. The average has remained relatively constant throughout all nine signups, but the cost can vary considerably for different conservation practices in different

Figure 12
CRP Enrollment Greatest in Plains and Mountain Regions

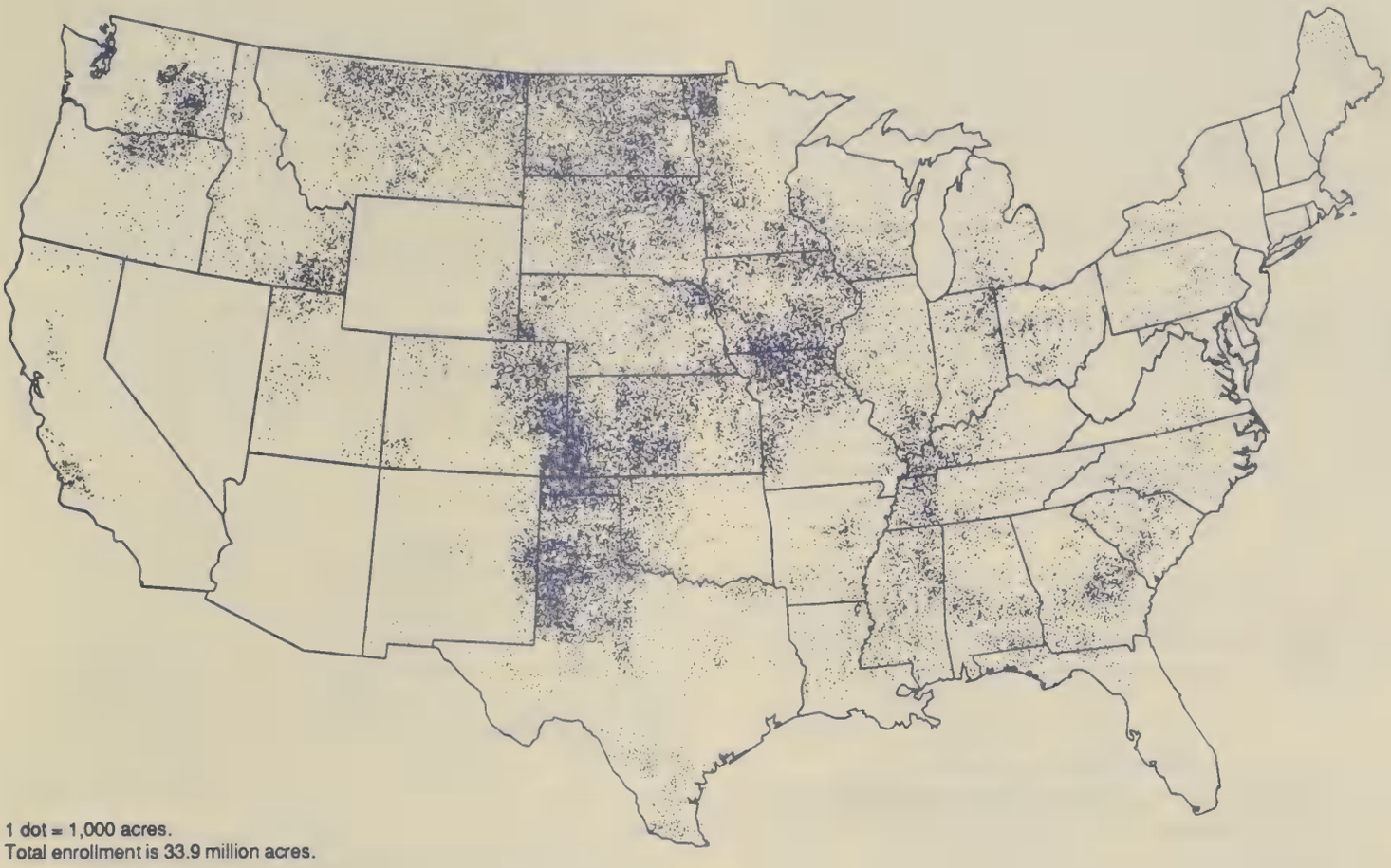


Signups 1-9. Total enrollment equals 33.9 million aces. Percentages at left show regional enrollment ■■ ■ percent of eligible acres. Numbers to the right show total eligible acres in the region.

Table 13--CRP enrollment, rental payments, and erosion reductions, signups 1-9

Region	Number of contracts	Total acres enrolled	Acres planted in trees	Reduced commodity base acres	Average rental payment	Average erosion reduction
	1,000	Million	1,000	Million	$/acre/year	Tons/acre/year
Northeast	5.5	0.20	8.9	0.07	59.62	13
Appalachian	26.0	1.06	139.6	.53	53.83	26
Southeast	31.4	1.57	1,207.4	.73	42.60	15
Delta States	16.3	1.09	625.3	.43	43.93	19
Corn Belt	80.1	4.73	62.9	2.65	73.04	18
Lake States	47.2	2.63	97.2	1.63	58.54	16
Northern Plains	73.4	9.43	8.4	6.48	45.94	15
Southern Plains	26.6	5.08	19.4	4.09	40.19	32
Mountain	20.3	6.44	4.4	4.02	39.73	19
Pacific	6.5	1.70	5.7	1.14	49.29	13
United States	333.4	33.92	2,179.3	21.76	48.93	19

Figure 13
CRP Enrollment, Signups 1-9



1 dot = 1,000 acres.
Total enrollment is 33.9 million acres.

locations. An estimated $1.3 billion has been spent since 1986 in cost sharing for all CRP cover establishment.

Grass is most popular conservation cover (table 14). Nearly 88 percent of CRP land has been planted with grasses. Trees, the second-most-popular cover, are planted on slightly more than 6 percent, or 2.1 million acres. This makes the CRP the largest conservation tree-planting program in the Nations's history, even exceeding the soil bank program of the 1960's. Special wildlife habitats were established on just under 6 percent of CRP land. In addition, CRP filter strip coverage stands at 49,000 acres along 5,000 to 6,000 miles of water bodies. The remaining acreage is scheduled to be placed in a variety of other conservation practices.

Cropped wetlands and scour erosion areas, made eligible for enrollment beginning with the eighth signup (February 1989), account for 410,000 and 143,000 acres. Scour erosion occurs when streams or rivers overflow into adjacent fields. Most of these areas will be planted in trees and, along with CRP filter strips, the practices are expected to improve water quality.

Table 14--CRP acreage treated by various conservation practices

Practice	Total Enrollment	
	Acres	Share of acres enrolled
	1,000	Percent
Grass cover	29,707	87.6
Tree planting	2,179	6.4
Wildlife habitat	1,974	5.8
Field windbreaks	7	0.0
Diversions	83	0.2
Erosion, sediment, & water control structures	40	0.1
Grass and sod waterways	15	0.0
Filter strips	49	0.1
Total 1/	33,922	100.0

1/ Acres where more than one practice was applied are counted only once in the total.

Wheat acres retired under CRP. In addition to providing environmental benefits, the CRP was established for commodity supply control. Farmers have retired 21.8 million acres of commodity base as a requirement for CRP participation. At 10.3 million acres, retired wheat base constitutes the largest portion, followed by corn (3.8 million acres), barley (2.7 million acres), and sorghum (2.4 million acres). Because these acres are ineligible for commodity program payments during the 10-year contract, the CRP reduces commodity program outlays.

Implementation Begins for Conservation Compliance

Conservation plans have been developed on more than 135 million acres of highly erodible cropland in response to conservation compliance provisions of the 1985 Food Security Act. Producers on about 70 percent of all farms (1.4 to 1.5 million) obtained plans from USDA which they must implement in order to retain their eligibility for future farm program benefits. Eligibility requires that producers actively implement their plans so that they are completed by January 1, 1995.

The plans include 100 million acres of conservation tillage, 25 million acres of contouring, 215,000 miles of terraces, 1.3 million acres of grassed waterways, and 4,700 miles of diversions.

When and if these plans are fully implemented, it is estimated that erosion on highly erodible lands will be reduced by 50 percent. However, the number of plans that actually will be implemented by 1995 is unknown. Farmers will base their decisions on the implementation cost of their plans and weigh the relative attractiveness of farm programs against their expectations of future market profitability.

Sodbuster and Swampbuster Enforcement Continues

Sodbuster requires that farmers who convert highly erodible native range or woodland to agricultural commodity production must do so under an approved conservation plan or forfeit eligibility for certain USDA program benefits. Swampbuster provides that farmers who plant an agricultural commodity on wetlands converted after December 23, 1985 will lose eligibility for USDA program benefits.

Ongoing USDA Programs Reduce Water Quality Problems

The Agricultural Conservation Program (ACP), the Conservation Technical Assistance (CTA) program, Extension Service, and other continuing USDA programs provide education, technical assistance, and cost sharing for water quality and other resource problems (see box, pg. 33). New educational materials and technical field guides have been prepared to assist farmers and USDA personnel in incorporating water quality considerations into conservation planning. New testing aids have been developed which permit rapid determination of the potential for chemicals to reach ground water.

Agricultural Conservation Program

Since 1984, conservation expenditures by the Agricultural Conservation Program have had four objectives: erosion control, water conservation, water quality, and wood production and other purposes (table 15). While the largest share of ACP expenditures has gone for erosion control, an increasing proportion is directed to water quality protection. In 1989, cost sharing for water quality protection was $15.9 million, up $2.5 million from the previous year and nearly double the amount from 5 years earlier. Between 1984 and 1989, expenditures with the primary purpose of erosion control declined from 75 percent of ACP expenditures to 68 percent, while the proportion of ACP expenditures with water quality protection as the primary purpose increased from 5 to 9 percent.

In 1989, $114.3 million was spent for erosion control cost sharing. The installed practices reduced annual soil erosion by an estimated 34.3 million tons. The average Federal cost share of reducing soil loss by 1 ton was $0.61.

Expenditures for water conservation increased from $19.8 million in 1984 to $25.8 million in 1989 but increased only slightly as a proportion of ACP expenditures. Approximately 644,000 acre-feet of water that would have been used in agriculture was conserved at an annual Federal cost share of $4.15 per acre-foot. Animal-waste management received over 50 percent of the $15.9 million cost-sharing expenditures on practices for the primary purpose of water quality protection. ACP funds spent on salinity control have been declining since implementation of an amendment to the Colorado River Basin Salinity Control Program in 1984 which provides cost sharing for on-farm improvements.

Permanent Cover Leads Conservation Practices

In 1989, cost sharing of conservation practices was provided on nearly 15 million acres (table 16). Cost-shared conservation practices were applied on 8.5 million acres while another 6.4 million acres benefited from protective practices such as terraces, diversions, sod waterways, and sediment and water control structures. Approximately 3 out of 4 treated acres received permanent grass or legume cover, mostly as part of the CRP. Tree planting was a distant second, comprising about 7 percent of the treated acreage, mostly under the CRP.

Before implementation of the CRP in 1986, 4 to 5 million acres were treated annually while another 3 to 7 million acres were served with cost-shared conservation practices under the ACP. The acreage treated and served by ACP cost-shared practices alone has been declining, while ACP expenditures are fairly constant. Because of CRP, however, conservation expenditures have tripled and the benefited area

USDA Conservation & Water Quality Programs

Activities in Support of the President's Water Quality Initiative

- Expanded **Education and Technical Assistance** is directed to selected demonstration projects, hydrologic unit areas, and special water quality projects to accelerate the adoption of water quality protection practices by farmers.
- Special **Research and Development** efforts are aimed at developing and identifying technology and production systems that reduce the environmental impacts of agricultural chemical use.
- New **Database Development and Evaluation** activities include collection and analysis of survey data from farmers on pesticide and nutrient use on major crops, and analysis of the economic and environmental impacts of water quality practices and programs.

Food Security Act (FSA) Provisions

- **Conservation Reserve Program** (CRP) provision is designed to reduce erosion on 40 to 45 million acres of farmland. Under the program, producers who sign contracts agree to convert highly erodible cropland to approved conservation uses for 10 years. In exchange, participating producers receive annual rental payments and cash or payments-in-kind to share up to 50 percent, with a limit of $50,000, of the cost of establishing permanent vegetative cover.
- **Conservation compliance** requires farmers with highly erodible cropland to implement an approved conservation plan by Jan. 1, 1990. The plan must be completed by Jan. 1, 1995 to maintain eligibility for Federal benefits.
- **Sodbuster and Swampbuster** provisions require that in order to be eligible for USDA program benefits, farmers who convert highly erodible land or wetlands to program commodity production must have an approved conservation system or a USDA determination that conversion would have only a minimal effect on wetland hydrology and biology.

Continuing Assistance Programs

These programs provide financial and technical assistance to farmers, ranchers, local organizations, and multicounty areas to implement practices to achieve soil and water conservation, water quality improvement, timber stand improvement, recreation use, and rural development.

The following are administered by the Soil Conservation Service (SCS):

- **Conservation Technical Assistance** (CTA), initiated in 1936, provides technical assistance to farmers by the Soil Conservation Service (SCS) through Conservation Districts.
- **Great Plains Conservation Program** (GPCP), initiated in 1957, provides technical and financial assistance in Plains States for conservation treatment on entire operating units.
- **Small Watershed Program**, initiated in 1954, assists local organizations in flood prevention, watershed protection, and water management.
- **Resource Conservation and Development Program** (RC&D), initiated in 1962, assists multicounty areas in enhancing conservation, water quality, wildlife habitat and recreation, and rural development.

The following are administered by the Agricultural Stabilization and Conservation Service (ASCS):

- **Agricultural Conservation Program** (ACP), initiated in 1936, provides financial assistance to carry out conservation and environmental protection practices on agricultural land.
- **Emergency Conservation Program**, initiated in 1978, provides financial assistance to farmers in rehabilitating cropland damaged by natural disasters.
- **Forestry Incentives Program** provides cost sharing up to 65 percent for tree planting and timber-stand improvement for private forest lands of 1,000 acres or less.
- **Water Bank Program**, initiated in 1970, provides annual payments for preserving wetlands in important migratory waterfowl nesting, breeding, or feeding areas.

Farmers Home Administration (FmHA) provides loans to farmers and associations of farmers for soil and water conservation, pollution abatement, and building or improving water systems that serve several farms.

Research and Extension Programs

- **Agricultural Research Service** (ARS) conducts research on new and alternative crops and agricultural technology to reduce agriculture's adverse impacts on soil and water.
- **Cooperative State Research Service** (CSRS) coordinates conservation and water quality research conducted by State Agricultural Experiment Stations and land grant universities. This agency allocates and administers funds appropriated for special and competitive grants for water quality research.
- **Economic Research Service** (ERS) estimates economic impacts of existing and alternative policies, programs, and technology for preserving and improving soil and water quality. With National Agricultural Statistics Service, collects data on farm chemical use, agricultural practices, and costs and returns.
- **Forest Service** (FS) conducts research on environmental and economic impacts of alternative forest management policies, programs, and practices.
- **Extension Service** (ES) provides information and recommendations on soil and water quality practices through educational programs for land owners and operators in cooperation with the State Extension Services and State and local offices of USDA agencies and Conservation Districts.

has doubled since 1986; the relatively smaller increase in the area benefiting from cost sharing is due to the rising cost of installing practices.

Update on Other Federal Programs

Federal agencies other than USDA continue to play a major role in research, data collection, and development of plans to control agricultural nonpoint sources of water pollution (box below.) The programs stress the need to intensify activities that prevent ground water degradation.

Environmental Protection Agency (EPA)

The EPA supports State nonpoint-source protection efforts through grants under Section 319 of the Clean Water Act. Through its national and regional offices, EPA supports State efforts by providing technical expertise and guidance. In addition, the Federal Insecticide, Fungicide, and Rodenticide Act, and the Safe Drinking Water Act provide EPA authority to develop programs to limit risk from pesticide use and protect public water supplies.

States Report Impaired Surface Waters from Agricultural Runoff

Under Section 305(b) of the Clean Water Act of 1972, the States periodically file reports to the EPA describing water resources that do not meet quality standards for designated uses (such as fishing and swimming). In the 1988 National Water Quality Inventory, three-fourths of all surface water assessed by the States fully met their water quality standards. States assessed 30 percent of river miles, 40 percent of lake acres, and 76 percent of estuary square miles for the 1988 inventory.

According to this inventory, nonpoint-source pollution resulting from such activities as agricultural tillage, pesticide application, and urban development is the chief cause of surface water degradation today. The relative share of point-source surface water quality problems, such as discharges from sewage treatment plants or industrial sources, appears to be diminishing following several years of pollution control efforts. Agricultural runoff is the single most extensive source of surface water pollution, accounting for 55 percent of impaired river miles and 58 percent of impaired lake acres assessed by the States in 1986 and 1987.

Non-USDA Conservation Programs Affecting Agriculture

- **1987 Water Quality Act Section 319 Programs**

  Section 319 of the act requires States and territories to file assessment reports with the Environmental Protection Agency (EPA) identifying navigable waters where water quality standards cannot be attained without reducing nonpoint-source pollution. States are also required to file management plans with EPA identifying steps they will take to reduce nonpoint-source pollution. All States have now filed assessment reports and management plans; final approval of the plans is underway. The act authorizes up to $400 million for implementing the plans; $37 million was awarded this year.

- **1987 Water Quality Act National Estuary Program**

  Section 320 of the 1987 Water Quality Act provides for identification of nationally significant estuaries threatened by pollution, preparation of conservation and management plans, and Federal grants to State, interstate, and regional water pollution control agencies for preparing the plans.

- **Pesticide programs**

  The Federal Insecticide, Fungicide, and Rodenticide Act of 1947 (FIFRA) provides the legal basis for regulating pesticides. The reregistration process of FIFRA (which requires EPA to approve the active ingredients used in agricultural insecticides and herbicides) could enhance ground water protection by controlling the use of highly leachable chemicals.

- **Regional Programs**

  The EPA and other Federal agencies are cooperating on several regional programs to address nonpoint-source pollution in specific areas. These include the Chesapeake Bay Program, the Colorado River Salinity Control Program, the Great Lakes Program, the Gulf of Mexico Program, and the Land and Water 201 Program (Tennessee Valley Region).

- **Safe Drinking Water Act**

  The Safe Drinking Water Act (SDWA) requires the EPA to publish drinking water standards (MCL's) for contaminants that may have adverse health effects. The standards apply to public water systems serving over 25 persons or with 15 connections. Standards established by the EPA under SDWA are being used as guidelines for assessing contamination of ground water supplies in private wells as well. The EPA also sets nonregulatory health advisories on contaminants for which MCL's have not been established. In addition, the SDWA established a wellhead program to protect sole-source aquifers from contamination by pesticides and agricultural chemicals.

EPA Grants Target Nonpoint-Source Pollution Control

The Water Quality Act of 1987 authorizes expenditure of up to $400 million by the EPA to help control water pollution from nonpoint sources. In 1990 the EPA awarded $37 million for administrative costs and demonstration programs to combat all forms of nonpoint-source pollution. This funding is the first significant award for nonpoint-source pollution control under the act.

EPA Completes Agricultural Chemicals in Drinking Water Survey

The EPA recently concluded its nationwide survey of agricultural chemicals in drinking water. The survey tested for 126 pesticides and related compounds as well as nitrates in drinking water wells. The survey was designed to give an accurate assessment of the extent to which the Nation's drinking water supplies could be affected by agricultural chemicals.

A sample was developed of 599 community water systems and 824 domestic wells in 90 counties, designed to give a representative picture of well water quality in the United States. Over 500,000 sample analyses were tested for the presence of agricultural chemicals. A summary of the findings will be released in the fall of 1990, and detailed results will be released by January 1991.

U.S. Geological Survey Plans 10-Year Water Quality Assessment Program

The U.S. Geological Survey is undertaking a 10-year effort to sample the Nation's surface and ground water resources to identify water resources affected by agricultural chemicals and other sources of degradation. This survey, under the National Water Quality Assessment Program, is more comprehensive than the EPA's drinking water survey, since it will provide a national assessment of the quality of all surface and ground water resources, not just the quality of drinking water at the tap. The survey will assess sources of contamination and the environmental fate of chemicals, with the goal of providing information to prevent further degradation of water quality. An initial focus of the program will be on agricultural origins of nonpoint-source pollution.

States Are Developing Water Quality Programs which Affect Agriculture

The States also have programs and legislation on water quality and agricultural chemical use. Most States have laws and regulations regarding agricultural chemical use, but only about one-third have developed preventive or remedial pro-

Table 15--Agricultural Conservation Program by primary purpose

Purpose	Unit	Year					
		1984	1985	1986	1987	1988	1989
Erosion control:							
Cost shares	$ million	111.4	126.4	93.5	95.4	133.8	114.3
Soil saved per year	Tons/acre	6.0	5.7	5.8	6.4	5.9	5.5
Soil saved over life of practice	Million tons	38.1	40.6	29.5	28.3	39.9	34.3
Cost share per ton of soil saved 1/	$/ton	0.60	0.60	0.60	0.60	0.59	0.61
Water conservation:							
Cost shares	$ million	19.8	20.9	15.1	15.1	27.7	25.8
Water conserved per year	Acre-feet	0.7	1.0	0.9	1.0	1.2	1.0
Water conserved over life of practice	1,000 acre-feet.	579.2	823.5	446.1	422.1	742.0	644.1
Cost share per acre-foot of water conserved 1/	$/acre-foot.	3.43	2.57	3.41	3.69	3.88	4.15
Water quality:							
Cost shares	$ million	7.2	10.2	9.3	9.5	13.4	15.9
		Percent of total cost shares					
Sediment		5.6	13.5	14.4	13.8	12.7	13.3
Animal waste management		55.4	49.1	47.1	42.8	51.1	50.2
Fertilizer		0.3	8.6	8.5	12.9	10.4	12.5
Toxics		0.0	1.7	0.8	1.7	2.8	2.5
Salinity		38.1	26.0	27.8	25.3	17.8	16.6
Other		0.7	1.1	1.5	3.5	5.1	5.0
Wood production and other:							
Cost shares	$ million	10.9	10.4	8.9	10.0	13.1	12.8
		Percent of total cost shares					
Wood production		31.7	50.2	65.0	57.5	69.1	72.2
Wildlife		5.7	7.4	8.2	6.0	10.2	7.8
Energy		11.0	13.3	8.2	5.2	6.6	4.8
Groundwater pollution Abatement		0.3	0.2	0.4	3.0	2.4	1.4
Groundwater recharge		0.1	0.0	0.0	0.2	0.1	0.1
Other		51.3	28.9	18.2	28.1	11.7	13.7
Total cost shares	$ million	149.2	167.9	126.6	127.0	188.0	168.8

1/ Amortization procedure.

Source: Agricultural Stabilization and Conservation Service.

Table 16--Acres treated or served by cost-shared practices, 1981-89

Practice and program	1981	1982	1983	1984	1985	1986	1987	1988	1989
					Million acres treated				
Permanent vegetative cover:									
Agricultural Conservation Program (ACP)	2.78	2.44	2.79	2.14	2.31	1.56	1.54	2.02	1.78
Conservation Reserve Program (CRP) 1/						1.70	12.42	7.84	4.57
Tree planting:									
ACP	0.13	0.11	0.10	0.08	0.12	0.13	0.15	0.20	0.17
CRP						0.21	0.76	0.52	0.45
Cropland protective cover:									
ACP	1.50	1.11	1.10	0.79	0.80	0.64	0.60	0.75	0.64
Conservation tillage:									
ACP	0.72	0.73	0.92	1.01	1.08	0.63	0.42	0.45	0.33
Strip cropping systems:									
ACP	0.12	0.12	0.13	0.10	0.13	0.09	0.08	0.14	0.12
Other Practices	0.06	0.08	0.06	0.06	0.07	0.07	0.14	0.11	0.11
Total acres treated 2/:									
ACP	5.31	4.59	5.10	4.18	4.51	3.12	2.93	3.67	3.15
CRP						2.04	13.67	8.76	5.35
Total Acres Treated	5.31	4.59	5.10	4.18	4.51	5.16	16.60	12.43	8.50
					Million acres served				
Grazing land protection (ACP)	3.44	2.68	2.74	2.54	3.03	2.03	1.74	3.60	3.77
Irrigation water conservation (ACP)	0.90	0.69	0.75	0.62	0.68	0.49	0.49	0.82	0.77
Terraces and diversions (ACP)	0.58	0.55	0.62	0.50	0.54	0.41	0.64	1.07	0.93
Water impoundments (ACP)	0.79	0.48	0.41	0.32	0.30	0.21	0.20	0.27	0.27
Sediment & water control structures (ACP)	0.42	0.30	0.31	0.22	0.23	0.22	0.17	0.25	0.22
Sod waterways (ACP)	0.73	0.49	0.45	0.21	0.23	0.18	0.13	0.22	0.17
Other practices (ACP)	0.43	0.39	0.38	0.29	0.27	0.25	0.18	0.25	0.27
Total Acres Served	7.29	5.58	5.66	4.70	5.28	3.79	3.55	6.48	6.40

1/ The CRP began in 1986. 2/ Includes some practices not listed.

Source: Agricultural Stabilization and Conservation Service.

grams to protect groundwater quality. With the EPA giving the States primary responsibility for ground water protection and requiring the development of State groundwater strategies, States have begun to respond by implementing programs of their own.

Some examples include:

- Iowa's Groundwater Protection Fund and its Groundwater Protection Strategy, which are supported in part by a tax on nitrogen fertilizer,
- Massachusetts' wellhead protection program, which established land use controls and restricts pesticide use in critical recharge areas around wells,
- Wisconsin's Risk Assessment Program, based on numerical ground water standards, and
- Minnesota's agricultural chemicals fee system, which creates a fund for monitoring research on the effects of chemicals on ground water.

States have also become more active in regulating agricultural chemical use. California's Proposition 65 imposes penalties for discharging carcinogenic chemicals or reproductive toxins into water supplies. Iowa recently restricted the use of atrazine, reducing permissible application rates from 4 pounds per acre to 3 pounds per acre in normal use, and to 1.5 pounds per acre where atrazine has been detected in ground water. Use is prohibited within 50 feet of a sinkhole, well, lake, or other surface water body. Colorado has enacted legislation which permits the Commissioner of Agriculture to regulate the use of agricultural chemicals in areas where ground water is felt to be vulnerable to degradation from agricultural chemicals.

Conservation Tillage Used on 72 Million Acres

Conservation tillage systems were applied on about 72 million acres during 1989 (table 17). Conservation tillage was

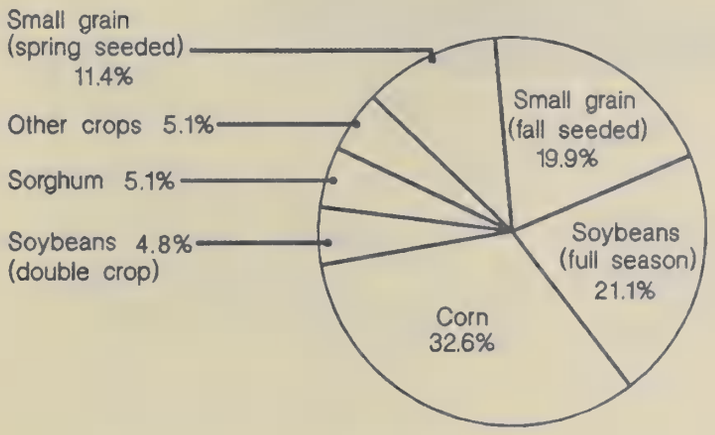
Table 17--National use of conservation tillage, 1983-89

	1983	1984	1985	1986	1987	1988	1989
				Million acres			
Total acres planted 1/	309	345	342	327	305	308	317
Acres planted with conservation tillage 2/	70	87	95	97	86	88	72 3/
				Percent of planted acres			
No-till	3.3	4.1	4.4	4.4	4.1	4.2	4.4
Ridge till	0.3	0.4	0.6	0.6	0.7	0.8	0.9
Other conservation tillage 3/	19.0	20.7	22.8	24.6	23.4	23.6	17.4
Total conservation tillage	22.6	25.2	27.8	29.6	28.2	28.6	22.7

1/ Estimates of acres planted to principal crops from the National Agricultural Statistics Service, USDA. 2/ Estimates of conservation tillage use from the National Surveys of Conservation Tillage Practices from the Conservation Technology Information Center, NACD. 3/ The definition of other conservation tillage was refined in 1989 from that used in previous years.

Figure 14

Conservation Tillage Acres by Crop, 1988



Share of total planted with conservation tillage.
Source: Conservation Technology Information Center.

used mainly on corn, soybeans, and small grain acreage (fig. 14). About 30 percent of the total acreage planted with corn, soybeans, and sorghum was conservation tilled. Conservation tillage was most frequently used with double cropping; over 55 percent of the double-cropped soybeans, 49 percent of double-cropped corn, and 37 percent of double-cropped sorghum acreage was produced with conservation tillage systems.

Conservation tillage refers to any tillage system leaving 30 percent or more of the soil surface covered with previous crop residue after planting. Two key factors influencing crop residue are the previous crop, which establishes the initial amount and fragility of residue, and the type of tillage operations prior to and including planting.

No-till and ridge till accounted for nearly 24 percent (almost 17 million acres) of the total acreage in conservation tillage. High-residue conservation tillage systems such as no-till and ridge till can leave as much as 70 percent of the soil surface covered with crop residues and offer more protection than conventional tillage systems or even other conservation tillage systems.

The recent upward trend in the use of high-residue conservation tillage systems is likely to continue as farmers respond to conservation compliance requirements, water quality standards, energy conservation objectives, and cost reduction goals.

The Corn Belt had the largest acreage of conservation tillage (fig. 15). Regions that had the largest area planted with crops—the Corn Belt, Northern Plains, and Lake States—also accounted for over two-thirds of total conservation-tilled acres in 1989. This is to be expected since these regions produce a significant amount of the total corn, soybeans, and small grain.

Conservation tillage adoption may reduce the potential for agricultural chemicals to reach surface waters but may increase the potential for degradation of ground water. By reducing water runoff and increasing infiltration, conservation tillage decreases the amount of agricultural chemicals that reach surface water when attached to sediment or dissolved in runoff. Increased infiltration, on the other hand, may increase the potential for dissolved chemicals to leach into ground water.

Conservation tillage, involving fewer trips over the field and reduced labor requirements, can generate immediate cost savings. If energy prices increase, conservation tillage will become more profitable because less fuel is consumed with fewer trips over the field. Fixed cost usually declines in the long run because a smaller machinery complement is needed for conservation tillage operations. However, conservation tillage systems may require higher management regarding the timing and placement of fertilizers and pesticides and carrying out tillage operations.

Conservation Expenditures Up Again in 1989-90

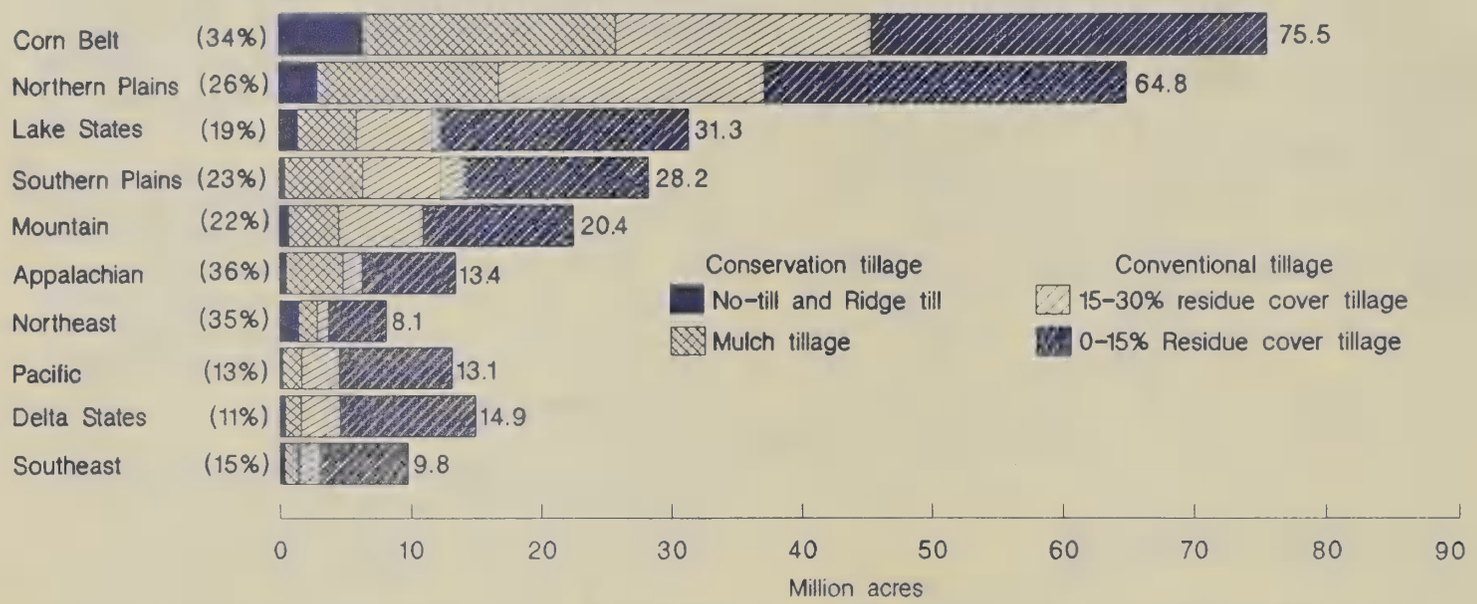
USDA and related State and local conservation expenditures could exceed $3.4 billion in 1990, up over $500 million from 1989 and over 2.5 times the 1986 level (fig. 16). The $1.8 billion spent by USDA on the CRP in 1990 is up almost $1.1

billion from 1987 and accounts for most of the increase. However, the net cost of the CRP is less than this amount because of its supply control benefits that reduce USDA's expenditures on commodity price support programs. (See section on CRP enrollment.)

State and local government appropriations to promote soil and water conservation have increased steadily in recent years. In some States, the increases have been used to supplement Federal CRP rental payments and to help landowners defray the cost of establishing vegetative cover.

USDA conservation expenditures are likely to reach over $2.9 billion in 1990, up $500 million from 1989 and $1.2 billion (two-thirds) from 1987 (table 18). The $3.4 billion for conservation proposed in the fiscal 1991 budget would exceed 1990 estimated spending. Although the proposal includes recommendations to consolidate and reduce some programs, the President's multiagency Water Quality Initiative proposes expanded funding for selected conservation, extension, and research programs.

Figure 15
Tillage Practices on Acres Planted by Region, 1989



Percentages at left show total regional conservation tillage use as a percent of acres planted in the region. Numbers to the right show acres planted in the region.
Source: Conservation Technology Information Center.

Figure 16
Conservation Expenditures by USDA and Related State and Local Programs, 1983-90

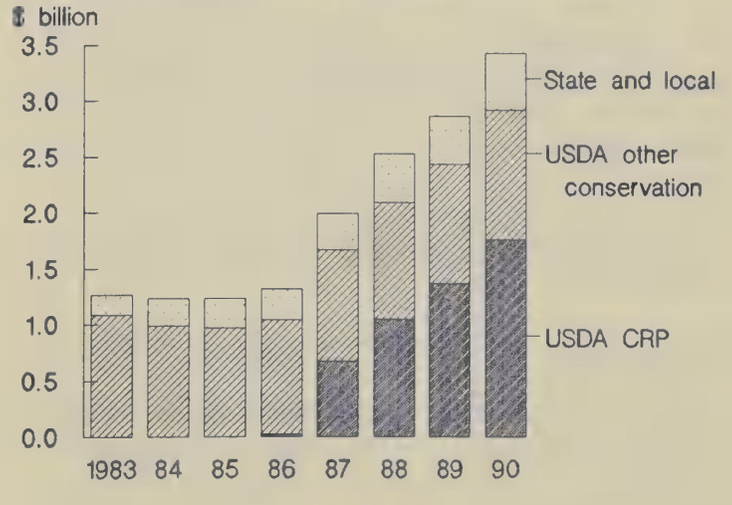
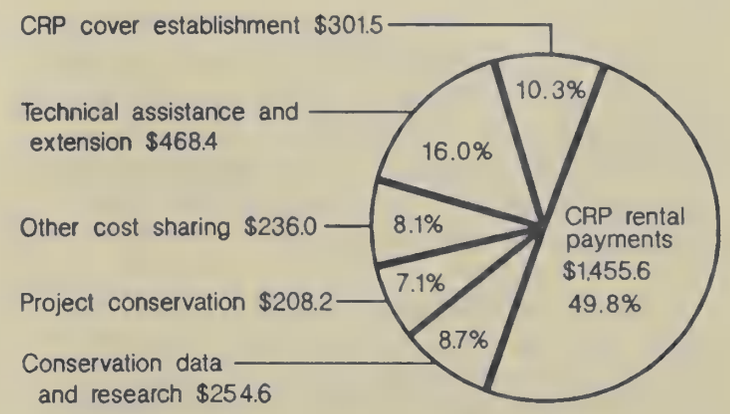


Figure 17
USDA Conservation Expenditures, 1990



In millions. Total expenditures: $2,924 million.

The 1990 CRP expenditure consists primarily of nearly $1.5 billion for rental payments on retired land and $302 million for USDA cost sharing to establish cover. Together these two CRP items represent over 60 percent of USDA conservation expenditures (fig. 17). Expenditures for technical assistance and extension services constitute about 15 percent of USDA conservation spending.

Erosion Levels Expected to Drop—Water Quality to Benefit

Movement of cropland soil by water and wind averaged around 3 billion tons annually during the early- to mid-1980's (table 19). While this erosion is less than the over 3.5 billion tons eroded annually during the Dust Bowl years of the 1930's, it results in a substantial public cost in terms of water quality deterioration and, to a lesser extent, lower soil productivity.

Table 18 --USDA conservation expenditures from appropriations, fiscal 1983-91 1/

Activities and programs 2/	All conservation expenditures								
	1983 actual	1984 actual	1985 actual	1986 actual	1987 actual	1988 actual	1989 actual	1990 estimated	1991 budgeted
	$ million 1/								
A. Technical assistance and extension	300.4	318.3	326.7	323.3	373.9	409.5	450.0	468.4	503.1
Conservation technical assistance (SCS) 3/	276.9	293.7	302.1	286.2	328.5	370.6	391.6	414.5	459.8
Extension information and education (ES)	15.9	16.0	16.4	16.3	15.7	18.1	19.8	23.0	32.4
Cooperative forestry management (FS)	7.6	8.6	8.2	10.0	7.7	15.2	10.7	22.7	10.9
Technical/assistance--CRP (SCS/ASCS) 4/	0.0	0.0	0.0	10.8	22.0	5.6	27.9	8.2	0.0
B. Cost sharing for practice installation	270.6	267.5	232.9	233.9	463.2	502.5	401.1	537.5	426.6
Agricultural Conservation Program (ASCS)	190.0	190.0	190.0	180.7	176.9	176.9	176.9	190.4	184.9
Forest Incentives Program (ASCS)	12.5	12.5	12.5	11.9	11.9	11.9	12.4	12.4	12.4
Water Bank Program (ASCS)	8.8	8.8	8.8	8.4	8.4	8.4	9.0	12.3	12.8
Great Plains Conservation Program (SCS)	21.3	21.3	21.6	20.5	20.5	20.5	20.5	20.9	24.6
Cover establishment--CRP (ASCS/CCC) 4/	38.0	34.9	0.0	12.4	245.5	284.8	182.3	301.5	191.9
C. Project conservation programs	324.5	207.9	219.0	292.3	210.8	201.0	197.5	208.2	176.0
Watershed and flood prevention (SCS)	246.7	150.0	192.7	265.2	185.8	175.9	172.4	180.9	151.1
Resource conservation & development (SCS)	77.8	57.9	26.3	27.1	25.0	25.1	25.1	27.3	24.9
D. Subtotal for implementation (A + B + C)	895.5	793.7	778.6	849.5	1047.9	1113.0	1048.6	1214.1	1105.7
E. Conservation data and research	191.5	196.3	192.0	196.2	210.1	218.6	224.6	254.6	271.6
Soil and water conservation research (ARS)	63.5	63.7	63.7	62.4	59.3	60.5	65.9	73.6	89.0
Cooperative State research (CSRS)	28.0	27.5	27.5	29.8	39.7	36.8	35.6	47.0	46.5
Forest environment research (FS)	19.6	20.4	20.3	23.9	27.7	28.3	29.5	35.5	36.6
Plant materials centers (SCS)	3.8	4.0	4.1	3.9	4.6	4.9	5.0	7.2	7.3
Resource economics research (ERS)	5.0	7.7	5.4	4.0	4.0	3.1	3.0	5.5	6.5
Data collection and analysis (SCS) 5/	71.6	73.0	71.0	72.2	74.8	85.0	85.6	85.8	85.7
F. Rental payments--CRP (ASCS/CCC) 4/	0.0	0.0	0.0	0.0	410.0	760.1	1162.1	1455.6	2061.7
G. Total distributed expenditures (D + E + F)	1087.0	990.0	970.6	1045.7	1668.0	2091.7	2435.3	2924.3	3439.0

1/ Current dollar estimates from budget of the U.S. Government for fiscal year 1991 (Appendix), and earlier years, supplemented with unofficial data from several sources. Includes water quality expenditures. 2/ Responsible USDA agencies in parentheses; CCC--Commodity Credit Corporation; SCS--Soil Conservation Service; ES--Extension Service; FS--Forest Service; ASCS--Agricultural Stabilization and Conservation Service; ARS--Agricultural Research Service; CSRS--Cooperative State Research Service; and ERS--Economic Research Service. 3/ Includes the SCS inventory and monitoring, resource appraisal, and program development activities carried out by SCS. 4/ All included as conservation, since the principal purpose of the CRP is conservation. 5/ Includes river basin surveys and investigations, soil surveys, and snow survey water forecasting.

Table 19--Food Security Act conservation programs may reduce cropland erosion by one-third

Time periods	Average total cropland erosion	Insight
	Billion tons per year	
1930's (Dust Bowl years) 1/	3.5+	Drought years; little conservation
1960's and 1970's 2/	2.6 to 2.8	Conservation applied generally
Early to mid-1980's 3/	3.0 to 3.1	Intensive farming offsets conservation efforts
1990's with Food Security Act conservation provisions in effect 4/	2.0 to 2.3	CRP and conservation compliance targeted to highly erodible cropland reduce erosion

1/ USDA yearbook of Agriculture, 1938, p. 595. 2/ 1967 and 1977 National Resources Inventories. 3/ 1982 and 1987 National Resources Inventories. 4/ Predictions based on current programs and prices. Policies or high prices that increase corn and soybean acreage could increase total erosion level on cropland.

The CRP program, with 33.9 million acres of highly erodible or environmentally sensitive cropland under contract, is estimated to reduce erosion by 655 million tons annually. Conservation compliance plans, with a possible erosion reduction of 300 to 500 million tons annually, would bring the total annual erosion level down to 2.3 billion tons by the mid-1990's, about one-third lower than in the mid-1980's. However, this reduction will not be achieved if programs or higher prices stimulate increased production of corn and soybeans.

Reducing erosion lowers not only the sediment delivered to streams and water bodies, but also sediment-attached and water-carried nutrients and pesticides. A billion-ton reduction in erosion from the CRP and conservation compliance provisions could reduce sediment entering surface waters by 13 to 18 percent, total phosphorous by 5 to 7 percent, and total organic nitrogen by 7 to 9 percent.

1990 Farm Bill Conservation Proposals

With another omnibus 5-year farm bill at hand, legislative programs that build upon the environmental accomplishments of the 1985 Food Security Act are being considered. Conservation proposals for the 1990 farm bill are focusing primarily on problems related to water quality, wetlands, forestation, and wildlife habitat.

In February, Agriculture Secretary Clayton Yeutter presented Congress with a list of recommended changes in farm programs. Among them were the following conservation proposals, reflecting the Administration's assessment of conservation needs.

- Extend enrollment in the CRP beyond the 1990 crop year through 1995, limiting total enrollment to no more than 40 million acres.

- Include the following in CRP eligibility: cropland within 1,000 feet of a well in a State-approved wellhead protection area; cropland in shallow karst areas; cropland identified in State nonpoint-source pollution plans as having priority problems resulting from agriculture; cropland posing a threat to endangered or threatened species; filter strips; other lands having potential for water pollution; existing cropped wetlands; and restorable cropped wetlands where wetland values and the probability of success are high and the costs of restoration are not excessive.

- Encourage the use of permanent easements for water quality and wetlands protection in addition to 10-year contracts.

- Modify commodity program requirements to give farmers more flexibility to rotate crops and to plant conserving crops.

Legislators in both the Senate and the House of Representatives offered additional conservation proposals. Following several months of numerous hearings, debates, and amendments, the Senate Committee on Agriculture, Nutrition, and Forestry and the House Committee on Agriculture each agreed on separate farm bills containing conservation titles. These bills were sent to the full Senate and House in early July where they underwent further modification and were later approved. These bills will go to a Senate-House conference committee.

CRP Would Be Extended Through 1995

The conservation titles developed by the Senate and the House of Representatives extend the period for CRP enrollment through the 1995 crop year and target additional acres for improving ground water quality, surface water quality, and wildlife habitat.

The Senate bill requires the enrollment of at least 40 million acres but no more than 50 million acres into the CRP. In determining whether to exceed the 40-million-acre minimum, the Secretary is required to consider effects on commodity prices and reserves, natural disasters, export market opportunities, and other factors relating to domestic and export requirements.

The House bill allows enrollment of up to 45 million acres but no minimum is specified. Not less than one-eighth of this is to be devoted to covers providing permanent wildlife habitat. Both bills provide for enrollment of marginal pastureland and provide enhanced incentives for tree planting.

Restoration of Wetlands

Both the Senate and House bills provide for protection of wetlands under permanent or long-term easements. The Senate bill calls for enrollment of at least 1 million acres of wetland as part of the CRP. Economic use of this land (e.g., timber harvesting, haying, grazing) would be allowed if specified in the conservation plan. Payment for easements cannot exceed the fair market value of the land and will be made in annual installments over 5 to 20 years. Cost sharing for restoration ranges from 50 to 100 percent depending on the length of the easement.

The House bill would establish a separate Wetland and Environmental Easement Program with a goal of enrolling, among other things, up to 2.5 million acres of wetland under perpetual easements. Commercial use of the land would be allowed if specified in the conservation plan, although agricultural commodity production is allowed only for wildlife benefit. Payment amounts could not exceed the value of the land or $250,000 total or $50,000 per year, and would be paid over a period of 1 to 10 years. Up to 100-percent cost sharing for restoration could be provided, and any commodity program base acreage would be permanently retired.

New Water Quality Programs

Agricultural water quality programs are proposed in the conservation titles of the 1990 Senate and House farm bills. Each proposal encourages farmers to implement water quality protection plans voluntarily in return for incentive payments, cost sharing, and technical assistance.

No acreage goal is specified in the Senate version. However, USDA would be required to enroll sufficient land to achieve water quality improvement. Contracts are for a minimum of 5 years, with incentive payments limited to $3,500 per year, paid over 3 to 5 years or in a lump sum.

The House version calls for at least 20 million acres to be enrolled during the 1991-95 crop years. As with the Senate bill, payments are limited to $3,500 per year, but wetland and wildlife habitat protection cost shares are limited to $1,500 per year. Payments would be made over 1 to 5 years with agreements of up to 5 years. During the agreement period, commodity base acreage and program yields would be protected.

Changes to Swampbuster: Mitigation and Graduated Penalties

The Senate and House conservation titles contain similar amendments to the Swampbuster provision established by the 1985 Food Security Act. Both would expand the definition of a Swampbuster violation to include conversion of a wetland for, or to make possible, production of an agricultural commodity. Under current law, Swampbuster sanctions are triggered only if an agricultural commodity is planted on converted wetland.

Both bills also provide for exemptions if it is determined that the farmer's actions will have minimal effect on functional hydrological and biological values or if the actions are mitigated through the restoration of prior converted wetland. Wetlands enrolled in easement programs could not be counted for mitigation purposes. Further, mitigation would have to be on a 1-for-1 acreage basis unless more acreage is required.

Finally, both bills also provide for graduated penalties depending upon the seriousness of the violation. A farmer could violate the Swampbuster provision once in 10 years if the farmer restores the wetland and if the conversion was not an intentional violation of the law. Fines could range from $750 to $10,000. Under existing law, farmers found in violation of Swampbuster lose eligibility for all USDA program benefits, even for minor violations. Environmental groups have argued that the extreme nature of the penalty has caused USDA to be lax in enforcing Swampbuster.

Planting Flexibility: Estimated Impacts on Cropping Patterns and Water Quality

by

Ian McCormick, Kazim Konyar, Ken Algozin and Marc Ribaudo[1]

Abstract: Planting flexibility removes the influence of crop-specific support payments and restores market price as the effective price for acreage and other resource allocation decisions. As the relative profitability of competing crops change, shifts in national and regional cropping patterns occur. Shifts in cropping patterns, under current market conditions, are estimated to benefit water quality nationally, reflecting changes in crop-specific tillage and chemical use practices. The magnitude and direction of these impacts varies by region and with the program design.

Keywords: Planting flexibility, ground water, surface water, cropping patterns, commodity programs, crop-specific supports

Introduction

Current agricultural policy employs a wide array of price supports, supply controls, marketing programs, and conservation programs to achieve public policy objectives. Many of the benefits as well as the costs associated with program participation are linked to the production of specific crops. Crop-specific policies, however, can distort production decisions. Distortions that lead to cropping patterns that are more erosive or employ chemical mixes at rates that are more likely to leach, can adversely affect water resources.

Increased flexibility in selecting crops (planting flexibility) could allow commodity program participants broader cropping opportunities without directly affecting income support payments. Increasing the range of cropping alternatives without directly affecting program benefits restores market price as the effective price for production and resource allocation decisions. While this movement toward greater market orientation is generally perceived as beneficial to crop market efficiency, the implications for nonmarket resources, such as water quality, are unclear.

This analysis focuses on the potential impact of planting flexibility on water quality. It discusses how increased crop selection flexibility can affect regional cropping patterns, and the influence of the shifts on chemical use, erosion, and water quality. It also evaluates the sensitivity of these results to the design of planting flexibility programs.

Effects of Crop-specific Support Programs

Under the provisions of the Food Security Act of 1985, income supports are determined on the basis of a producer's crop acreage base history and yield history. Base is crop specific and currently only applies to the major feed grains (corn, sorghum, barley, and oats), wheat, rice and cotton.

Although yield histories were limited in 1985, base acreage continues to be calculated as a 5-year moving average of acres planted and considered planted.[2]

To guarantee annual benefits and to maintain eligibility for subsequent years, a producer must fulfill certain obligations. These include land diversion requirements such as the Acreage Reduction Program (ARP), and land use restrictions such as cross compliance and conservation provisions.[3] Also, participating farmers are generally required to plant the crop to which the base applies (e.g., corn on corn base) or divert those acres to a conserving use. During the last 2 years, limited shifts to certain alternative crops were allowed in exchange for foregoing deficiency payments, without affecting the producer's eligibility for other program benefits. Failure to comply with these provisions could result in the forfeiture of support payments and a reduction in future base acreage. Maintaining base is important to ensure future benefit levels.

The crop-specific nature of these provisions, in effect, links annual support payments to the production of a specific crop (program crop) and raises the returns from program crop production relative to some nonprogram crops. Higher and more stable returns encourage maximizing production of program crops. But because the production practices associated with program crops are often more erosive and more reliant on agrichemicals, shifts toward program crops can adversely affect ground and surface water resources (1).

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[2] Acreage considered planted includes acreage idled in annual commodity programs and acreage that was prevented from being planted due to factors such as drought, flood, or other natural disasters.

[3] "Cross compliance" refers to a condition for loan and support payment eligibility for a crop, which may require a farmer to limit acreage in other program crops to the base in that crop.

Benefits that are linked to the production of a specific crop can also influence rotations. To guarantee access to future program benefits, a producer must first establish a base acreage history and maintain it by planting the crop to which the base applies. On a farm where the concentration of base acres for a specific crop is large relative to that farm's total acreage, maintaining base may impede the planting of alternative crops or shorten rotational sequences. Since rotations can be an important component in soil and pest management, maintaining base can lead indirectly to greater use of commercial fertilizer and pesticides (2). Substituting commercial chemicals for rotations increases the potential for chemical leaching and runoff.

Crop Selection Flexibility: Three Scenarios

In its simplest form, the concept of planting flexibility diminishes the rigidity of current crop selection limitations by allowing participating farmers to choose from a wider range of crops to plant on a portion of their base acreage. Under the scenarios presented here, opting to plant an alternative crop would no longer result in a direct loss of support payments or base history. The specification of key provisions, including permitted crops, retention of support payments, land diversion and compliance obligations, cropping alternatives, and the proportion of base defined as flexible, would vary according to specific policy objectives.[4]

Three distinct scenarios are presented here, to illustrate the effects of changes in the degree of flexibility and in land diversion requirements (see box).[5] The scenarios are evaluated in terms of the effect on cropping patterns, surface water quality, and the vulnerability of ground water resources to chemical leaching. Results are presented in terms of percentage change from a 1990 base year and indicate how the farm sector might have responded to increased flexibility given the structure and market conditions of the farm sector in 1990.[6]

Flexibility Can Reshape Cropping Patterns

By allowing program participants to select from a wider range of crops without directly reducing program benefits on flexed acres, market prices replace income support prices as the effective price for production decisions on base acreage. Since target prices for many program crops are currently higher than market prices, effective prices for crop selection decisions would decline under a flexible policy. This would change the relative profitability of competing crops and result in cropping pattern changes both nationally and regionally.

Nationally, fewer acres remain in production under all three scenarios (fig. B-1). A decline in harvested acreage (i.e., an increase in fallowed acreage) implies that at market prices, returns from marginal lands would fail to cover the cost of production. However, the decline in total harvested acreage is small, ranging from less than 1 percent to 3 percent.

Because relative support levels differ among crops, the effect of planting flexibility on crop-specific acreage also varies.[7] Harvested acreage declines most significantly for

Planting Flexibility Scenarios

Scenario A allows participating farmers to shift 20 percent of their base acreage to any combination of wheat, corn, barley, oats, sorghum, rice, cotton, soybeans, hay, or fallow, with no loss in base acreage history. Support payments are assumed to continue on flexible acreage based on historical acreage and yields, and are not affected by planting decisions. Crop-specific ARP rates apply to both flexible and nonflexible base and are set at 1990 actual levels. On flexible acreage the ARP rate is determined by the crop selected. Other relevant factors that may effect the final outcome, such as the Conservation Compliance obligations, are assumed to remain in place. The Conservation Reserve Program remains at the projected 1990 level.

Scenario B allows all base acreage to be flexible. A crop-specific ARP remains in place and is determined by the crop selected to be planted on the flexible acres. Other options and provisions correspond to scenario A.

Scenario C is a variation on scenario B. All base acres are eligible for the flexible option. However, the ARP for all base acreage is set at a flat 10 percent to eliminate any crop-specific land diversion advantages.

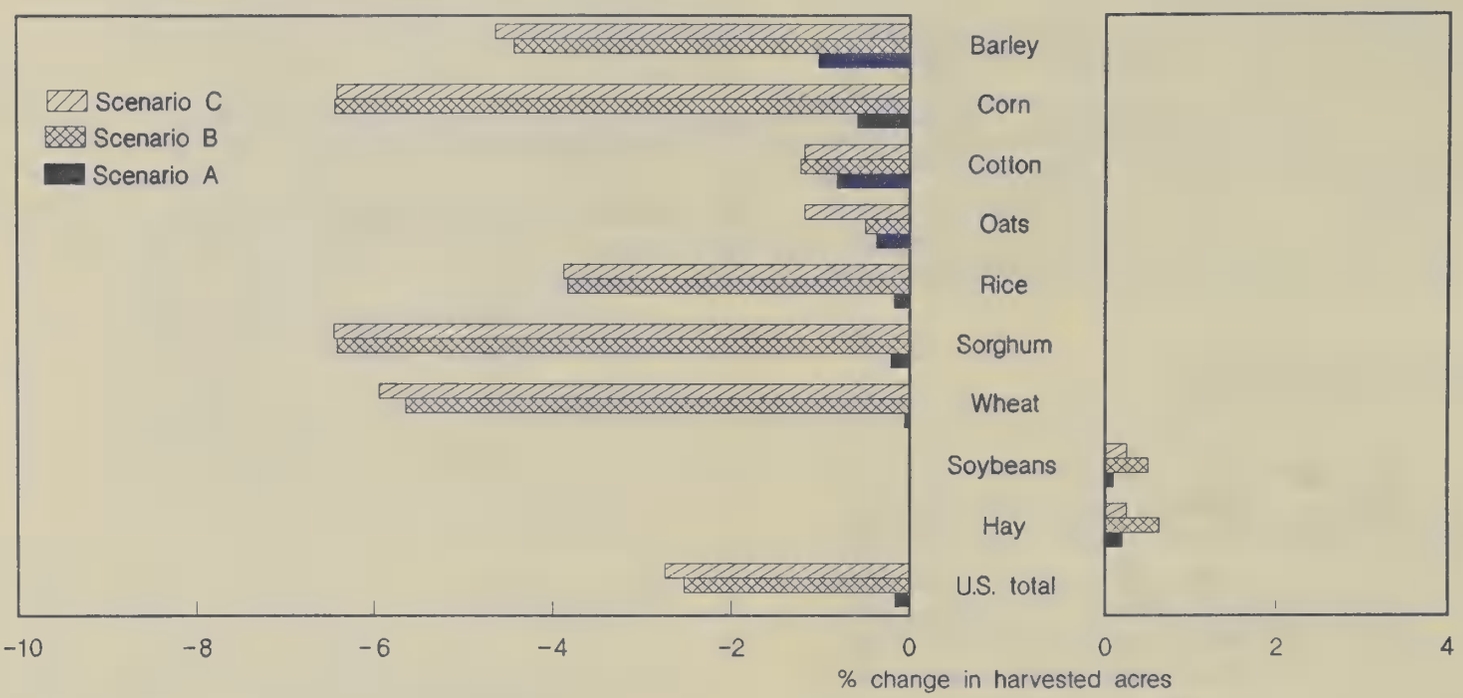
[4] A number of recent policy proposals have included the concept of increased crop selection flexibility. See, for example, the Administration's 1990 farm bill proposal, decoupling proposals, the triple base option, and early versions of the House and Senate farm bills.

[5] The scenarios presented here were chosen to illustrate the potential impacts of a range of increased crop selection flexibility options and do not necessarily represent specific proposals.

[6] Estimates of regional cropping pattern shifts are derived from a national nonlinear programming model, which allows regional prices to vary in response to changes in supply. The resulting effects on water quality were then estimated by allocating regional cropping patterns over surface and ground water resources via separate ground and surface water models. The techniques used in this model are described in Appendix I, II, and III of Ervin, et al. (3).

[7] Relative support levels reflect the per-acre value of deficiency payments, accounting for the lost opportunity on ARP acreage and the savings in production costs.

Figure B-1
Crop Acreage Effects of Planting Flexibility



crops with higher relative support rates such as corn, sorghum, wheat, barley, rice, and cotton. Acreages of soybeans (only eligible for a loan rate) and hay (a nonprogram crop) are estimated to increase under all three planting flexibility scenarios.

Regionally, changes in acreage use under flexibility policies do not necessarily parallel national trends (fig. B-2). For example, under scenario B, the total acreage harvested declines by more than the national average in the Northern Plains (8 percent), the Mountain region (5 percent), and the Pacific States (3 percent). Net declines are due primarily to declines in program crop acreage, suggesting that support prices are currently maintaining production on otherwise unprofitable acreage.

In contrast, under scenario B, total harvested acreage is estimated to increase in the Delta region by 2 to 3 percent. The increase is a result of shifts toward program crops with lower land diversion requirements.

Water Quality Can Benefit

The effect of changes in cropping patterns on water quality depends on many factors, such as physical site characteristics (climate, soils, topography, and hydrogeologic conditions), crop choice, tillage practices, chemical mix, application rates, and the number of acres in production. In this analysis, changes in water quality reflect changes in the number of acres in production and changes in the mix of crops produced on those acres.

Ground Water Quality

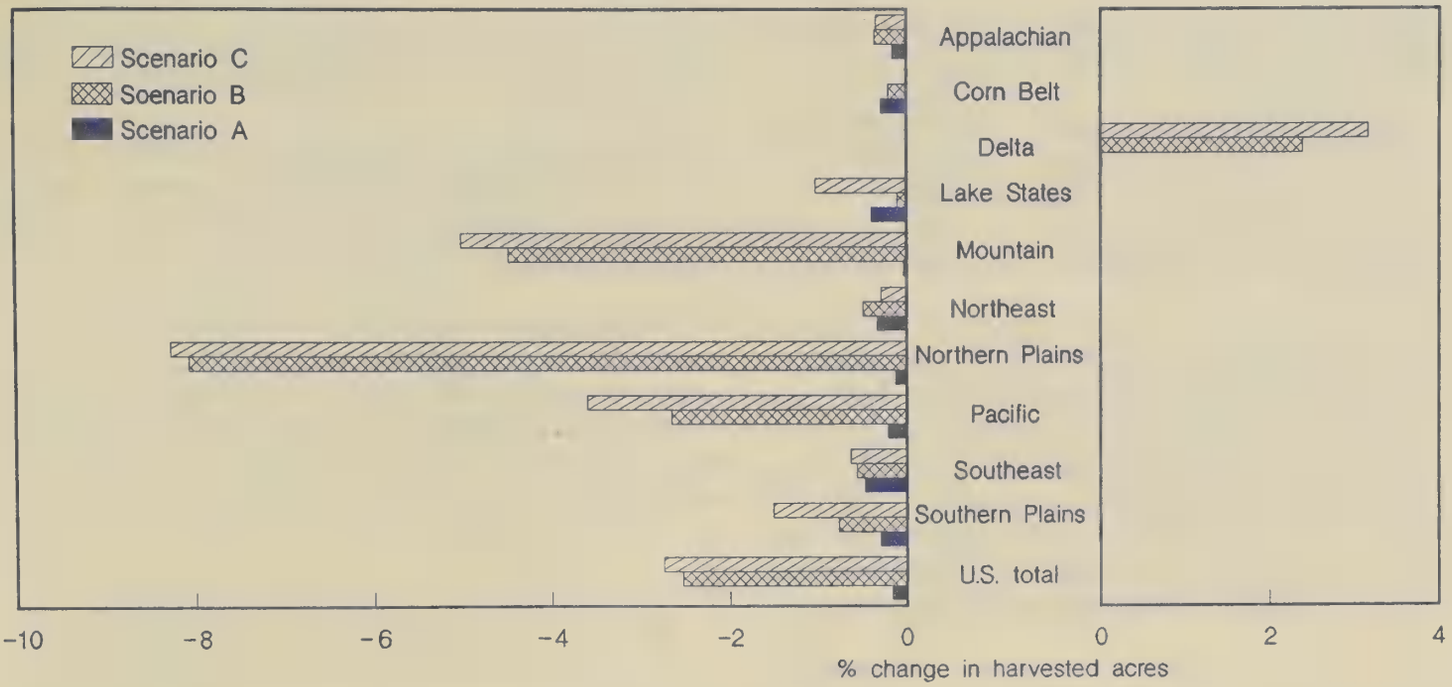
Potential changes in ground water quality are inferred by assessing changes in the potential for nitrogen and pesticides to leach in areas most susceptible to leaching.[8] Nationally, both nitrogen and pesticide leaching potential decline (table B-1). However, the overall declines are small, ranging from less than 1 percent to 4 percent. In some regions the changes are more pronounced for specific scenarios. The uneven regional changes are due to regional variability in cropping pattern shifts combined with differences in regional vulnerability to leaching associated with specific crops.

For example, with 100% flexibility (scenarios B and C), pesticide leaching potential declines most significantly in the Southern Plains (23-24 percent). Wheat production in the Southern Plains is associated with chemical mixes and use rates that are less likely to leach than either corn or sorghum. The decline coincides with reductions in the number of acres treated combined with an increase in wheat acreage as corn and sorghum acreage declines.

In contrast, pesticide leaching potential is estimated to increase in the Mountain region by 25 to 27 percent under scenarios B and C. The increase, which occurs despite notice-

[8] The model used to estimate leaching focuses only on areas where ground water resources are most susceptible to chemical leaching. Changes in potential leaching reflect changes in the number of acres planted to specific crops in these areas. Chemical mixes and application rates are held constant by crop and by region.

Figure B-2
Regional Acreage Effects of Planting Flexibility



able declines in regional acreage use, is due to a net increase in corn acreage in areas where hydrogeologic conditions are highly susceptible to leaching.[9]

Nitrogen leaching potential is projected to decline most noticeably in the Northern Plains (13 percent). The decline reflects a net decline in acres treated combined with a crop shift from wheat to soybeans and hay. Soybeans, a crop able to fix atmospheric nitrogen, and hay, are typically associated with production practices that employ less nitrogen per acre than wheat in the region (4). Nitrogen leaching potential increases most significantly in the Delta due primarily to an increase in the number of acres treated.

Surface Water Quality

Changes in surface water quality are estimated in terms of the expected dollar benefits and costs associated with consumer benefits for recreational fishing, defensive expenditures for water navigation (e.g., dredging costs), flood control and reparation, municipal water use, installation of ditches, and production costs for industrial water use and municipal water treatment.

Nationally, increased planting flexibility is projected to benefit surface water quality as producers move towards less erosive crops and as the number of acres harvested declines (table B-2). Annual benefits range from $3 million to $53 million, increasing as program flexibility increases.

Regionally, the positive effect of planting flexibility on surface water quality is estimated to be greatest in the Northern Plains. Benefits are derived from an increase in the relative percentage of hay acreage, a decrease in wheat acreage, and an overall decline in harvested acreage. Hay production is associated with less erosive production practices than wheat because of the annual tillage requirements for wheat that expose soils to runoff.

Surface water quality is estimated to decline under planting flexibility in the Delta. The decline, with annual costs ranging from less than $2 million to $40 million, results from an overall increase in harvested acreage combined with an increase in corn and soybean plantings relative to other, less erosive, crops.

Program Design Can Influence Effects

A comparison of the three scenarios indicates that the effects of a planting flexibility policy on cropping patterns and water quality would vary as program rules change. While the direction of these impacts remains consistent overall, the extent of the impact varies with the degree of flexibility and with different diversion requirements.

[9] The allocation of cropping shifts within a region is linked to the traditional location of production of a specific commodity in relation to the resource base (soils, aquifers, etc.). In regions where the distribution of a specific crop (in this case corn) is concentrated in areas more sensitive to leaching, ground water impacts may be larger despite only modest changes in regional cropping patterns.

Contrasting the results from scenarios A and B illustrates the effects of changing the degree of flexibility. Increasing the number of acres eligible for planting flexibility is estimated to encourage more cropping pattern shifts as more acreage is exposed to market price signals (figs. B-1 and B-2). Larger acreage and crop mix response translates into greater changes in chemical leaching potential and surface water quality benefits (tables B-1 and B-2.). In general, in regions where the impacts of planting flexibility were estimated to be positive, increasing the degree of flexibility would amplify the gains. The opposite is true for those regions where planting flexibility is estimated to adversely impact chemical loadings.

Comparing scenarios B and C illustrates the effect of a variation in land diversion requirements. Land diversions represent a cost to producers in terms of foregone returns on idled acreage. Differential diversion rates (scenario B) tend to favor those crops with lower diversion requirements. Standardizing the rates by requiring all program participants to divert 10 percent of their base acreage (scenario C) balances potential costs and allows producers to base cropping decisions on the relative profitability of crops, given market prices.

Harvested acreage declines slightly more with equalized land diversion requirements, due primarily to a larger land diversion requirement for wheat (the ARP rate for wheat in 1990 was 5 percent). However, larger changes in the mix of crops produced under crop-specific diversion requirements result in larger potential water quality benefits. Nationally, the differences in cropping pattern and water quality effects are not great. Regionally, differences between the two land diversion schemes are more pronounced.

For example, regions traditionally dominated by a specific program crop (e.g., wheat in the Northern Plains) are less sensitive to a change in the land diversion design. In other areas, such as the Southern Plains, where a wider range of program crops are grown, the differences between the two scenarios are more noticeable.

Table B-1--Regional effects on nitrogen and pesticide leaching potential

Region	Nitrogen leaching potential Scenario A	Scenario B	Scenario C	Pesticide leaching potential Scenario A	Scenario B	Scenario C
	Percentage change in leaching potential					
Appalachian	1/	1/	1.8	1/	-3.7	-2.1
Corn Belt	1/	-3.9	-3.8	-1	1/	1/
Delta States	1/	3.7	4.5	1.6	23.1	23.9
Lake States	1/	-1.1	-1.9	1/	-9.8	-10
Mountain	1/	-1	-1.7	3.6	27.3	25.7
Northeast	1/	3.1	3.5	1/	3.6	3.8
Northern Plains	1/	-13.1	-13.2	1/	-16	-16.1
Pacific	1/	-2.6	-3.7	1/	-5.4	-6.1
Southeast	1/	-1.8	-1.5	1/	3	3
Southern Plains	1/	1/	-1.7	1/	-24	-23.3
United States	1/	-3.7	-3.8	1/	-4.2	-4

1/ Less than 1 percent change in leaching potential

Table B-2--Annual surface water benefits of planting flexibility, by region

Region	Scenario A Low	Scenario A High	Scenario B Low	Scenario B High	Scenario C Low	Scenario C High
	$ million					
Appalachian	1/	1/	1/	1/	1/	1/
Corn Belt	1/	3.3	1/	1/	1/	1/
Delta	1/	1/	-6.5	-35.8	-7.4	-40.7
Lake States	1/	1/	7.3	22	7.8	23.6
Mountain	1/	1/	2.6	8.1	2.1	5.6
Northeast	1/	1/	1/	-4.5	-2.1	-7
Northern Plains	1/	1/	6.3	50.1	6.4	50.3
Pacific	1/	1/	2.6	8.1	3.1	9.6
Southeast	1/	1/	1/	1/	1/	1/
Southern Plains	1/	1/	2.4	8.3	2.9	9.8
United States	2.8	8.6	12.6	53.2	12.5	50.3

1/ Indicates less than a $2 million change in regional surface water quality.

Impacts on Rotational Practices Unclear

Rotations can be an important component of pest and weed control, soil protection,and fertility management. Under certain conditions and with proper management, rotations can lead to reductions in chemical fertilizer and pesticide requirements. Reductions in these inputs can benefit water quality.

This analysis does not account for potential changes in per-acre input use as output prices change or possible input use changes resulting from changes in rotational practices. Data on input substitution and the costs and returns associated with different rotations were not available.

Planting flexibility would eliminate certain impediments to the adoption of rotations that have been associated with crop-specific support programs. However, rotational practices are also influenced by factors other than current program provisions. Simply eliminating institutional barriers will not guarantee adoption of rotations. Concern over profitability, special equipment requirements, and limited cropping alternatives can also impede rotations. In cases where profitable economic alternatives exist and are adopted, planting flexibility can facilitate the adoption of rotations that in turn can benefit water quality.

Conclusion

Planting flexibility is generally perceived to improve the efficiency of crop markets by removing the influence of crop-specific price supports and restoring market prices as the effective price for production decisions. This analysis indicates that given the current situation and structure of agricultural production, planting flexibility would also benefit both surface and ground water quality.

Benefits reflect shifts toward crops that are less stressful to the environment, complemented by a reduction in the total number of acres in production. However, the benefits are small nationally and are unevenly distributed across the various production regions. Due to data deficiencies regarding rotations and the potential for reductions in chemical use, the estimates of impacts on water quality are conservative.

The amount of acreage eligible for planting flexibility was shown to have a significant effect on the magnitude of these changes. Increasing the proportion of acreage eligible for planting flexibility was estimated to benefit both surface and ground water quality. Different land diversion requirements did not result in large differences nationally, but regional impacts were noted.

Because planting flexibility does not target specific production practices or the location of those practices relative to areas vulnerable to erosion, runoff, or leaching, the policy would not necessarily enhance (or diminish) water quality. Factors such as the concentration of specific crops, the nature of the soil, and the proximity to sensitive water resources, all influence the effects of cropping patterns on water resources.

Finally, it is important to note that changes in commodity program structure could have indirect impacts on the environment. Because a number of the soil conservation programs are attached via compliance requirements to price supports (e.g., conservation compliance, Sodbuster, and Swampbuster), a drop in participation could have an adverse impact on the environment. Moreover, shifts to more erosive crops, as in the case of the Delta, may not meet the individual compliance requirements for some farms.

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Production, Resource Use, and Operating Characteristics of Participants and Nonparticipants in Farm Programs

by

Merritt Padgitt [1]

Abstract: Federal farm programs provide some protection of land and water resources through compliance provisions in commodity and other agricultural programs. The effectiveness of broadening compliance provisions to reduce the use of agricultural chemicals and to conserve soils depends on the participation rates under voluntary programs. Compliance, as a requirement for receiving benefits from any voluntary program, may not be an adequate policy vehicle for resource protection if most farms do not participate. Special summaries of the 1987 Census of Agriculture show that program participants produced about one-half of all agricultural output, managed about three-fourths of the cropland, and applied about 70 percent of the agricultural chemicals. The need for land and water resource protection from agricultural chemicals extends beyond the geographic areas, farm types, and farm sizes that have been most attracted to Federal programs.

Keywords: Conservation compliance, farm programs, Federal payments

Summary

Federal farm programs have traditionally contained provisions that offer some protection to the Nation's agricultural land and water resources. Broadening the eligibility requirements for program benefits to include restrictions of chemical use that is detrimental to water quality is an option for further protection. Additional requirements for eligibility for Federal farm program benefits would likely reduce their attractiveness, and consequently fail to provide comprehensive protection.

According to the 1987 Census of Agriculture one-third of all farms participate in Federal farm programs, but less than 15 percent receive most of the direct payments. Participants account for half of the Nation's agricultural production, land, and net farm returns. They operate three-fourths of the cropland, apply 71 percent of the fertilizers and 68 percent of the chemicals according to special summaries from the 1987 Census of Agriculture. About 90 percent of the wheat, cotton, and rice and 83 percent of the feed grains were grown on farms that participate in Federal programs. Producers of nonprogram crops and livestock frequently do not participate but account for 28 percent of the harvested cropland and most of the pasture, range, woodland, and other agricultural land.

Participation rates were lowest among the smallest and the largest farms. Highest levels of participation occurred on farms between 1,000 and 2,000 acres in size, with $50,000 to $250,000 in sales, or with real estate assets between $500,000 and $2 million. While two-thirds of all farms received no direct Federal payments, an additional 20.5 percent received payments of less than $10,000 per farm. The remaining 13 percent received 85 percent of all direct Federal farm program payments, collecting an average of $30,340 per farm in 1987. The largest share of payments went to cash grain farmers, and the payments were most concentrated in the Corn Belt and Plains regions.

Introduction

Along with price stabilization and farm income support goals, Federal farm programs also contain provisions to protect our Nation's land and water resources. To be eligible for benefits, farmers must comply with various requirements aimed at protecting wetlands and wildlife habitats, controlling noxious weeds, and reducing soil erosion on highly erodible land. Broadening agricultural policies to reduce agricultural fertilizer and chemical use when detrimental to the environment or perceived as a risk to food safety would likely reduce the attractiveness of voluntary programs.

The Federal voluntary programs offer economic incentives through price disaster payments, nonrecourse loans, cost sharing, and low-interest loans. To be eligible for these benefits, farmers must comply with certain contract provisions, including the conservation provisions of the 1985 Food Security Act. Farm operators who do not receive benefits from Federal farm programs are exempt from compliance requirements, and they do not have to adopt resource protection practices if no other Federal or State regulations apply.

This article highlights the resource use and characteristics of participants and nonparticipants in Federal farm programs using special summaries from the 1987 Census of Agricul-

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ture. Participants are defined as farm operations that receive any cash payments or payments in kind from Federal farm programs. These include benefits such as deficiency payments, "whole-herd dairy buy-out," support price payments, indemnity programs, disaster payments, paid land diversion, inventory reduction payments, or payments for approved soil and water conservation projects. Participants also include farmers who place any portion of their production in the Commodity Credit Corporation (CCC) for nonrecourse loans or have any acreage under the annual commodity acreage adjustment programs or the conservation reserve program.

Both participants and nonparticipants may get indirect benefits from higher market prices or technical assistance from USDA agencies. The indirect benefits include those derived from production agreements and marketing quotas, including the programs for dairy, peanuts, sugar, and tobacco. Farmers who received indirect benefits or Farmers Home Administration loans, but did not participate in other programs nor have CCC loans, were not classified as participants.

Federal Programs: A Third of the Farms, Half the Production

While only one-third of all U.S. farms were participants in Federal programs in 1987, participating farms accounted for a larger share of the production, land, expenditures, and net farm returns (table C-1, fig. C-1). Program participants sold 49 percent of the farm products, purchased 49 percent of the inputs, operated 50 percent of all land in farms, and earned 52 percent of the net cash returns.[2] These shares include farms receiving direct cash payments but may exclude farms that indirectly benefit from higher market prices, as in the dairy, peanut, sugar, and tobacco programs.

Federal farm programs were generally attractive in 1987 and enjoyed high participation. Commodity market prices were depressed from the record-high and near-record-high world supplies of major crops during 1986 and 1987. Target prices for program crops remained relatively high, and farmers relied on deficiency payments to offset expected lower net returns from depressed market prices. Enrollment in programs requiring acreage reduction peaked in 1987 at 197.6 million acres accounting for 87 percent of the effective base acres on Agricultural Stabilization and Conservation Service (ASCS) records.[3] In addition, CCC loans made during 1986 and 1987 were at a record high. Consequently, the 1987 census information represents a year of peak involvement by farmers in Federal programs.

[2] Net cash returns in this article refers to the difference between market value of all sales and total operating expenditures. It does not account for change in inventories, depreciation, receipt of farm program payments, or off-farm income.

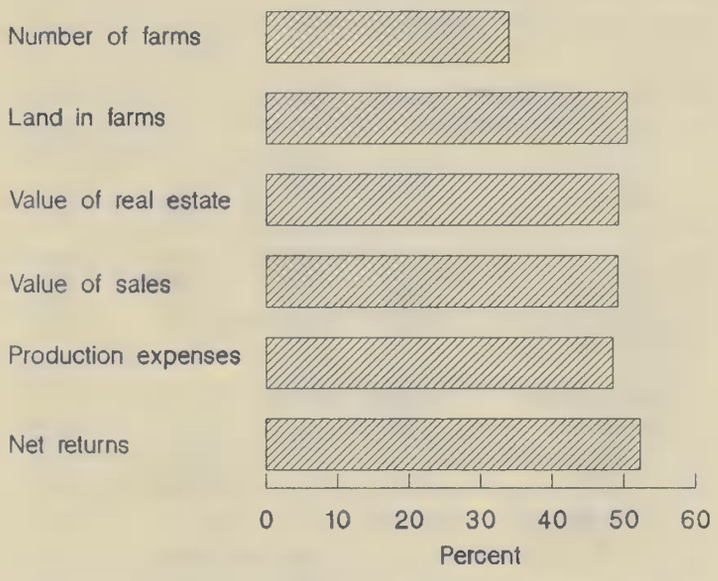
[3] Effective base acres are the total base acres in ASCS records less any base acres enrolled in the long-term Conservation Reserve Program. For further information see Table 5 in the Cropland section of this report.

Table C-1--Participation in Federal farm programs, 1987

	All farms	Farms participating	Percent participation
Farms (1,000s)	2087.8	707.2	33.9
Land in farms (million acres)	964.5	486.4	50.4
Value of Land & Bldgs. ($ bil)	604.2	297.4	49.2
Market value of sales ($ bil)	136.0	66.8	49.1
Production expenditures ($ bil)	108.1	52.4	48.5
Net Returns ($ bil)	26.4	13.8	52.3

Source: 1987 Census of Agriculture, Special summaries

Figure C-1
Participation in Federal Programs, 1987



Source: Special summaries from 1987 Census of Agriculture

Three-fourths of Cropland Farmed by Participants

Cropland accounts for 46 percent of all land in farms while pasture, range, woodland, lots, and other land occupy the remainder. While participants operated one-half of the farmland in 1987, they farmed nearly three-fourths of the cropland (table C-2, fig. C-2). Over 90 percent of the participants' cropland was on farms that were enrolled in commodity programs requiring acreage reductions (ARP). The ARPs, which target the producers of feed grains, wheat, cotton, and rice, were the predominant programs attracting participation. ARP participation requires that the farmer set aside a certain percentage of cropland normally used to produce a particular crop and put that land to a conserving use.

Few Federal farm programs specifically target pasture, range, and woodland for benefits. The majority of this land is operated by farmers who do not have cropland enrolled in an ARP and receive no direct Federal farm program benefits. Approximately 70 percent of the pasture, private range, and woodland, and 52 percent of other uses of land occurred on nonparticipating farms.

Provisions of the 1985 Food Security Act seek to prevent the conversion of pasture, woodland, or other land to crop production if it is a wetland or highly erodible land. The "Sodbuster" and "Swampbuster" provisions deny program benefits to farmers who make that conversion. Any pasture, range, woodland, or other land operated by participants which has the potential for conversion to cropland and is considered environmentally sensitive is subject to these provisions. The provisions, however, only affect operators who participate in a Federal program. Because many owners of these resources are not attracted to Federal programs, the compliance measures do not apply to all potentially convertible cropland. Approximately 100 million acres of erodible land or wetlands have a medium or high potential for conversion to cropland (3).

Table C-2--Participation in Federal farm programs, by major land use, 1987

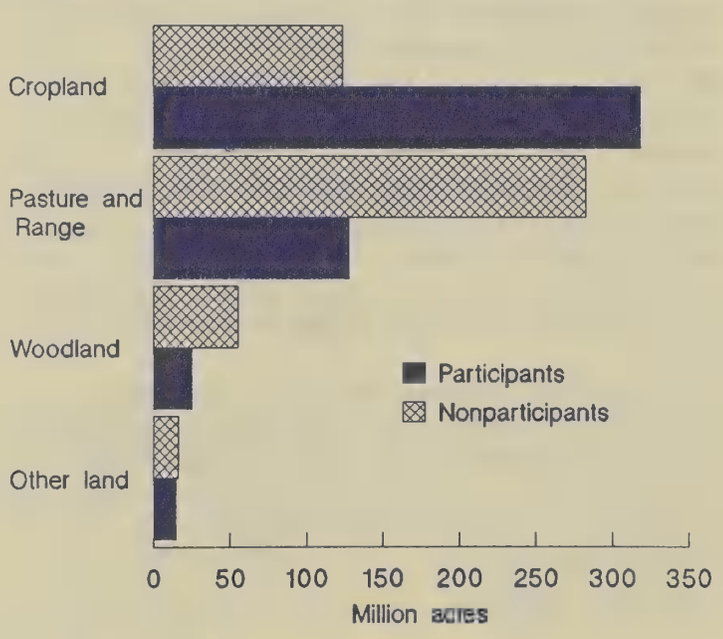
	All farms	Farms participating	Farms not participating	Percent participation
	- - - - 1,000 acres - - - -			
Cropland	443,318	318,827	124,490	71.9
Harvested	282,223	212,807	69,416	75.4
Crop failure	3,638	2,388	1,249	65.6
Summer fallow	35,322	30,873	4,448	87.4
Pastured	64,979	26,065	38,913	40.1
Idle & cover crops	57,153	46,677	10,476	81.7
ARP	43,152	43,152	0	100.0
CRP	9,870	9,870	0	100.0
(Cover crops) 1/	19,633	16,664	2,968	84.9
Pasture & Range	410,329	127,601	282,727	31.1
Woodland	79,894	25,241	54,653	31.6
Pastured	40,549	9,447	31,101	23.3
Not pastured	39,345	15,796	23,548	40.1
Other land	30,928	14,751	16,177	47.7
All land in farms	964,470	486,421	478,049	50.4

1/ Cover crops may occur on land idled under government programs.

Source: 1987 Census of Agriculture, special summaries.

Figure C-2

Land Use by Participation in Federal Programs, 1987



Source: Special summaries from 1987 Census of Agriculture

Participants Use Most Fertilizers, Agricultural Chemicals

The contribution of fertilizers and agricultural chemicals to the productivity and efficiency of agriculture is well recognized. Concerns about water quality, a safe environment, and even potential risk to human health from applied plant nutrients and pesticides have raised policy issues on ways to reduce their use or their impact on the environment.

The census reports about 22 percent of all land in farms was treated with some type of commercial fertilizer and 18 percent was treated with chemical herbicides in 1987. Participants in Federal programs operated about three-fourths of the fertilized acreage and 81 percent of the acreage treated with herbicides (table C-3). Participants' share of expenditures for commercial fertilizers and agricultural chemicals is slightly less than treated acreage, with about 71 percent of the fertilizers and 68 percent of the agricultural chemicals purchased by participants (table C-4).

Most Program Crops Produced by Participants

According to the 1987 Census of Agriculture, the program crops corn, sorghum, barley, oats, wheat, rice, and cotton account for 55 percent of the harvested U.S. cropland and 37 percent of total crop sales (table C-5). To participate in these programs and be eligible for deficiency or disaster payments and nonrecourse loans, farmers were required to set

Table C-3--Participation in Federal programs, by acres treated with commercial fertilizer and agricultural chemicals, 1987

	All farms	Farms participating	Farms not participating	Percent participation
	- - - - 1,000 acres - - - -			
Commercial Fertilizer	211,072	160,488	50,584	76.0
Lime	12,585	8,397	4,188	66.7
Chemicals for control of:				
Weeds	171,287	138,289	32,997	80.7
Insects	68,826	52,836	15,989	76.8
Nematodes	5,931	4,368	1,562	73.7
Diseases	10,467	6,185	4,281	59.1
Growth regulators, etc.	9,497	7,699	1,797	81.1

Source: 1987 Census of Agriculture, special summaries.

Table C-4--Participation in Federal programs by production input expenditures, 1987

	All farms	Farms participating	Farms not participating	Percent participation
	- - - - $ million - - - -			
Commercial fertilizer	6,684	4,732	1,952	70.8
Agricultural chemicals	4,690	3,175	1,515	67.7
Seeds, etc.	3,390	2,356	1,034	69.5
Electricity & petroleum	7,502	4,298	3,203	57.3
Labor 1/	14,885	5,881	9,004	39.5
Cash rents	4,689	3,471	1,217	74.0
Interest & property tax	11,278	6,400	4,877	56.8
Livestock & feed	38,508	13,778	24,729	35.8
Other expenses	16,507	8,296	8,211	50.3
Total expenditures	108,138	52,391	55,746	48.5

1/ Hired labor, contract labor, and all custom work.

Source: 1987 Census of Agriculture, special summaries.

aside part of their normally planted acreage. The 1987 set-aside requirements were 27.5 percent for wheat, 25 percent for cotton, and 20 percent for feed grains.

These programs were attractive to most producers, with 83 percent of the feed grain acreage and about 90 percent of the wheat, cotton, and rice acreage grown on farms operated by participants (table C-6). The 1987/88 deficiency payment rates (difference between target price and market price or loan rate) was $1.09 per bushel for corn, $1.81 per bushel for wheat, $17.30 per bale for cotton, and $4.82 per cwt for rice.

Most soybeans were also produced by farmers who participated in Federal programs. Although no deficiency payments or set-aside requirements were offered for soybeans, producers were eligible for CCC loans or disaster payments. Nearly 90 percent of the soybeans were produced on farms that received benefits from a Federal farm program.

Few direct payments are specifically available to producers of hay, fruits, vegetables, and specialty crops. A significant proportion of these commodities, however, were produced on farms that participate in Federal programs. These nonprogram crops account for 24 percent of the harvested cropland and 47 percent of crop sales. Many of these commodities use high levels of chemical applications and are frequently produced in areas most vulnerable to ground water contamination.

Cash Grain Farms Most Likely Participants

Participation in Federal farm programs was highest among producers who specialize in the production of cash grains. For farms to be classified as a particular specialty (Standard Industrial Classification), it must derive 50 percent or more of its sales from a special class of products. Cash grain farms include those specializing in the production of wheat, feed grains, rice, soybeans, sunflowers, dry beans, peas, or other grain crops. About 73 percent of cash grain farms were participants (table C-7).

Producers who specialize in other crops or livestock, or had no specialty, represent over three-fourths of all farmers. Federal programs were less attractive to these farmers, with only about 22 percent participating. Lowest participation was among producers of fruits, vegetables, specialty crops, and poultry. Participation by farmers who specialize in dairy and beef was slightly higher because they often produce program crops for livestock feed.

Lowest Participation by Smallest, Largest Farms

Participation was lowest among the smallest and the largest farms (table C-8, fig C-3). Increasing levels of participation were reported for farms up to 2,000 acres, having up to $250,000 in sales, and up to $2 million in real estate assets. Participation rates were somewhat lower for farms with over 2,000 acres, over $250,000 in sales, or over $2 million in real estate assets. The ARPs and other programs have a per-farm payment limitation of $50,000. This limitation reduces the attractiveness of Federal programs to these large farmers because they are still subject to the same percentage set-aside requirements and other compliance provisions as smaller farms.

Less than half of the farms that operate under 260 acres, harvest under 100 acres, sell less than $50,000 in farm products, or have real estate assets under $500,000 participated in any farm program. The majority of small farms have not been attracted to Federal farm programs.

Table C-5--Value of commodity sales by participation in Federal farm programs, 1987

	All farms	Farms participating	Farms not participating	Percent participation
		$ million		
Fruits & vegetables 1/	17,556	2,228	15,327	12.7
Feed grains 2/	12,549	11,307	1,242	90.1
Soybeans	9,125	7,983	1,141	87.5
Other crops	8,918	5,642	3,275	63.3
Wheat	4,827	4,305	522	89.2
Cotton	4,207	3,693	514	87.8
Tobacco	1,745	899	846	51.5
Hay, silage, & seeds	2,598	1,382	1,216	53.2
All crops	58,931	36,059	22,871	61.2
All livestock	77,517	30,692	46,825	39.6
All sales	136,448	66,751	69,696	49.1

1/ Includes fruits, vegetables, melons, berries, nuts, nursery and greenhouse sales. 2/ Includes corn and sorghum for grain, barley and oats sold for grain.

Source: 1987 Census of Agriculture, special summaries.

Table C-6--Participation in Federal farm programs, by crop acres, 1987

	All farms	Farms participating	Farms not participating	Percent participation
		1,000 acres		
Feed grains 1/	89,407	74,174	15,232	83.0
All hay	57,967	26,852	31,115	46.3
Soybeans	55,291	47,438	7,852	85.8
Wheat	53,224	47,181	6,042	88.6
Cotton	9,826	8,798	1,027	89.5
Fruits, veg. etc. 2/	8,027	2,080	5,947	25.9
Rice	2,424	2,208	216	91.1
Peanuts	1,436	1,087	348	75.7
Tobacco	633	303	330	47.9
Other crops	3,985	2,682	1,303	67.3
Harvested cropland	282,223	212,807	69,416	75.4

1/ Includes acres of corn for grain & silage and sorghum, barley, and oats for grain. 2/ Includes acres for fruits, vegetables, melons, berries, nuts, nursery and greenhouse crops.

Source: 1987 Census of Agriculture, special summaries.

Table C-7--Participation in Federal farm programs, by farm type, 1987

	All farms	Farms participating	Farms not participating	Percent participating
		1,000 farms		
Cash grain	458.4	336.5	121.9	73.4
Cotton	27.7	24.3	3.4	87.6
Tobacco	87.8	15.8	71.9	18.0
Other field crops	128.2	29.0	99.2	22.6
Horticultural, vegetables, fruits, and specialty	148.6	8.3	140.2	5.6
Livestock	892.3	202.5	689.7	22.7
Dairy	138.3	52.4	86.0	37.9
General farms	57.9	20.4	37.5	35.2
Poultry & animal specialty	148.7	18.0	130.6	12.1
All farms	2,087.8	707.2	1,380.6	33.9

Source: 1987 Census of Agriculture, special summaries.

Other Characteristics of Participants

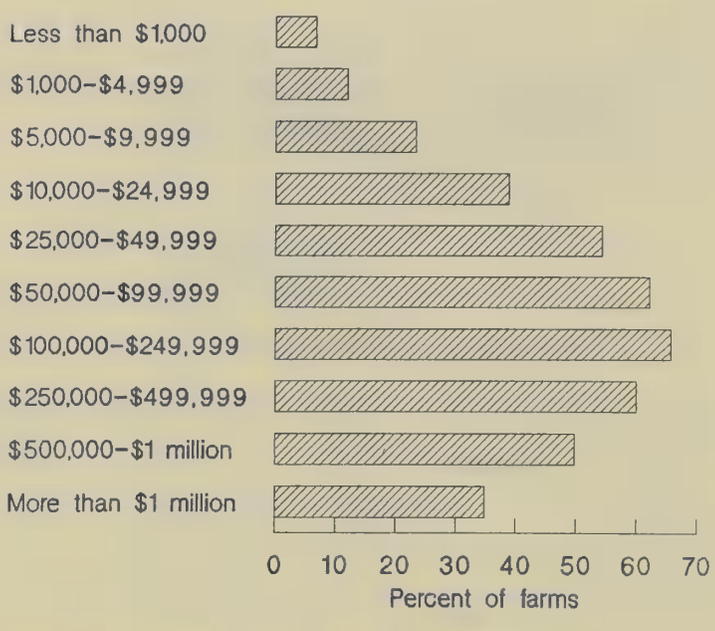
Operators who worked up to 100 days off their farms participated in programs at about the same frequency as those who did not have any off-farm employment. The frequency of participation was lower for operators who worked more than 100 days off their farms as well as those who reported their primary occupations to be other than farming (table C-9).

Table C-8--Participation in Federal programs by farm size, 1987

	All farms	Farms participating	Farms not participating	Percent participating
	- - - - 1,000 farms - - - -			
Farm acreage class:				
1 to [illegible] acres	906.6	100.0	806.5	11.0
100 to 179 acres	334.0	104.8	229.2	31.4
180 to 259 acres	192.1	81.7	110.4	42.5
260 to 499 acres	286.2	163.7	122.5	57.2
500 to 1,000 acres	200.1	140.7	59.3	70.3
1,000 to 2,000 acre	102.1	75.9	26.2	74.3
2,000 acre +	66.8	40.4	26.4	60.4
Harvested acres:				
1 TO 99 acres	1,007.8	207.9	799.9	20.6
100 TO 199 acres	236.4	141.6	94.8	59.9
200 to 499 acres	253.3	197.6	55.7	78.0
500 to 999 acres	105.0	91.3	13.7	87.0
1,000 to 1,999 acres	33.9	29.6	4.3	87.3
2,000 acres +	7.2	5.9	1.3	81.6
Farm sales class:				
Less than $1,000	235.6	15.8	219.7	6.7
$1,000 to $4,999	517.7	62.0	455.7	12.0
$5,000 to $9,999	275.0	63.9	211.0	23.3
$10,000 to $24,999	326.2	126.5	199.7	38.8
$25,000 to $49,999	219.6	119.3	100.3	54.3
$50,000 to $99,999	218.1	135.7	82.4	62.2
$100,000 to $249,99	202.6	133.1	69.5	65.7
$250,000 to $499,99	61.1	36.7	24.5	60.0
$500,000 to $999,99	20.9	10.4	10.5	49.7
$1 Million or more	11.1	3.9	7.2	34.8
Farm real estate asset class:				
Less than $40,000	322.3	36.7	285.6	11.4
$40,000 to $99,999	535.1	112.2	422.9	21.0
$100,000 to $199,999	487.8	160.6	327.2	32.9
$200,000 to $499,999	465.5	228.7	236.8	49.1
$500,000 to $999,999	177.9	111.5	66.4	62.7
$1 mil. to $1.9 mil.	69.0	44.1	24.9	63.9
[illegible] mil to $4.9 mil	24.0	13.1	10.9	54.5
[illegible] million or more	6.1	2.3	3.8	37.7

Source: 1987 Census of Agriculture, special summaries.

Figure C-3
Participation by Farm Sales Class, 1987



Source: Special summaries from 1987 Census of Agriculture

Farmers who had operated their farms for more than 10 years represent two-thirds of all farmers and were more likely to participate than beginning farmers. Farmers under 35 years of age had the highest levels of participation, but they account for only 13 percent of all farmers.

Distribution of Farm Program Payments

The 1987 Census of Agriculture reports that farmers received $9.6 billion dollars in the form of commodity certificates or direct cash payments for participation in Federal programs. These benefits exclude indirect price support benefits through provisions of the dairy, peanuts, tobacco, and sugar programs. Program payments made in 1987 represent the second-highest year ever (4). The direct payments in 1987 were equivalent to 35 percent of the net cash return from all farm sales, 14 percent of the gross value of production from all cropland, and 9 percent of all farm production expenses. The value of direct payments received by farmers exceeded their expenses for all agricultural chemicals, commercial fertilizers, petroleum products, and interest expense.

Eighty-five percent ($8.1 billion) of all payments went to 13 percent (268,000) of the farms, with the average payment size $30,000. Less than 40,000 farm operators (1.8 percent) receiving the largest payments were paid over $3 billion. About 15 percent of all farms (304,000) received less than $5,000 each, and 66 percent (1.4 million) received no Federal payments for agricultural programs.

While the distribution of payments was somewhat concentrated among a few farms, the payments were commensurate with their size and the value of sales (table C-10). Farms operating over 2,000 acres received 19 percent of the pay-

Table C-9--Farm operator characteristics by participation in Federal farm programs, 1987

	All farms	Farms participating	Farms not participating	Percent participating
	- - - 1,000 farms - - -			
Occupation of operator:				
Farming	1,139.2	531.4	606.7	46.7
Other occupation	949.6	175.7	773.8	18.5
Race of operator:				
White	2,043.1	700.7	1,342.4	34.3
Blacks and other minority	44.6	6.4	38.2	14.4
Place of residence:				
On Farm	1,487.9	520.7	967.2	35.0
Off Farm	442.6	153.3	289.3	34.6
Not reported	157.2	33.1	124.1	21.1
Days worked off farm:				
None	844.5	365.7	478.7	43.3
1 to 99 days	200.0	89.8	110.32	44.9
100 to 199 days	178.3	53.9	124.4	30.2
200 or more days	737.2	150.9	586.3	20.5
Not reported	127.7	46.8	123.0	36.6
Years on present farm:				
2 years or less	113.6	32.0	81.6	28.1
3 to 4 years	135.5	35.0	100.5	25.8
5 to 9 years	303.9	86.3	217.6	28.4
10 or more years	1,163.3	461.2	702.1	39.6
Not reported	371.5	92.8	278.7	25.0
Age of operator:				
Under 35 years	278.5	115.9	162.6	41.6
35 to 49 years	634.4	212.1	422.3	33.4
50 to 64 years	727.5	253.7	473.8	34.9
65 years or older	447.3	125.4	321.9	28.0

Source: 1987 Census of Agriculture, special summaries.

Table C-10--Distribution of farms, farm sales, land in farms, cropland, and Federal payments by farm size and farm type

Farm size class Characteristics	Percent of all Farms	Percent of farm sales	Percent of land in farms	Percent of cropland	Percent of payments
Farm acreage class:					
1 - 99 acres	43.4	15.9	3.5	4.8	2.1
100 - 179 acres	16.0	8.2	4.7	6.6	4.2
180 - 259 acres	9.2	7.1	4.3	6.2	5.0
260 - 499 acres	13.7	16.9	10.7	16.4	17.3
500 - 999 acres	9.6	19.8	14.4	23.0	28.2
1,000 - 1,999 acres	4.9	15.0	14.4	20.9	24.4
2,000 or more acres	3.2	17.1	48.0	22.1	18.7
Farm Sales Class:					
Under $5,000	36.1	1.1	9.3	6.5	1.9
$5,000 - $9,999	13.2	1.4	4.7	4.8	2.0
$10,000 - $24,999	15.6	3.9	9.6	10.4	6.6
$25,000 - $49,999	10.5	5.8	11.5	12.9	11.1
$50,000 - $99,999	10.4	11.5	16.8	19.5	20.8
$100,000 - $249,999	9.7	22.9	23.3	26.6	33.7
$250,000 - $499,999	2.9	15.2	11.8	11.1	14.8
$500,000 - $999,999	1.0	10.3	6.5	4.7	6.0
$1 million or more	0.5	27.8	6.5	3.5	3.2
Farm type class:					
Cash grain	22.0	18.3	25.6	45.7	58.7
Cotton	1.3	3.1	2.4	4.2	7.3
Tobacco	4.2	1.2	1.1	1.3	0.5
Other field crops	6.1	4.4	4.1	5.1	3.0
Horticultural, vegetables, fruit and specialty	7.1	12.6	1.8	2.5	0.8
Livestock	42.7	33.4	54.0	29.1	20.3
Dairy	6.6	13.2	4.6	6.9	4.6
General farms	2.8	2.0	2.1	2.9	2.9
Poultry & animal specialty	7.1	11.7	4.3	2.3	1.9
Size of Federal payment received:					
None	66.5	1/	1/	1/	0
$1 - $999	4.4	1/	1/	1/	0.4
$1,000 - $4,999	10.0	1/	1/	1/	5.8
$5,000 - $9,999	6.1	1/	1/	1/	9.4
$10,000 - $24,999	7.3	1/	1/	1/	25.2
$24,000 - $49,999	3.7	1/	1/	1/	27.8
$50,000 or more	1.8	1/	1/	1/	31.3
Age of Operator:					
Under 35 years	13.3	12.8	10.5	14.1	15.4
35 to 54 years	41.5	47.5	42.3	44.0	46.4
55 to 64 years	23.7	26.2	26.6	25.6	26.3
65 years or older	21.4	13.5	20.7	16.2	12.0

1/ Data summaries are not available.

Source: 1987 Census of Agriculture.

ments. While these large farms accounted for only 3.2 percent of all farms, they operated 22 percent of the cropland and made 17 percent of all farm sales. Farms that sold over $500,000 received 9 percent of the payments, but they operated 8 percent of the cropland and made 38 percent of the farm sales.

The greatest concentration of payments went to cash grain farmers. These farmers received 59 percent of the payments, but only operated 46 percent of the cropland and produced 18 percent of the farm sales. Farmers who specialize in beef and hogs are the most common farm type and account for half of all land in farms. These farms received 20 percent of the payments, operated 29 percent of the cropland, and produced one-third of the sales.

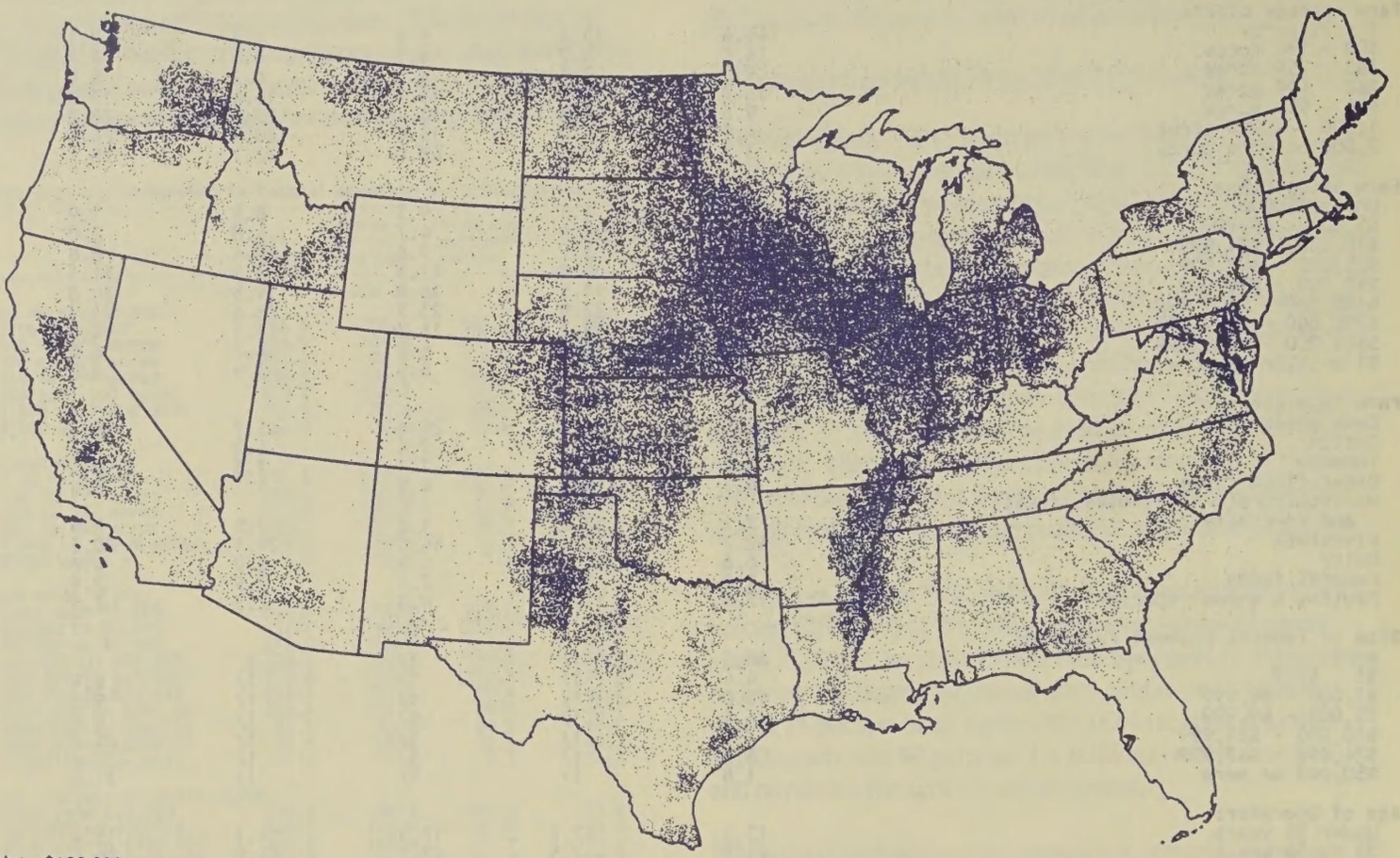
Federal farm program payments are geographically concentrated in the midcontinent States with Iowa, Illinois, and Nebraska receiving the largest share of payments (fig. C-4). These three States, receiving 29 percent of the payments, contain 17 percent of the cropland and produce 16 percent of all farm products sold.

Implications for Compliance Provisions

Linking compliance provisions to receipt of Federal farm program payments offers one approach to protecting the Nation's agricultural land from soil depletion and its water resources from contamination. The compliance provisions could be broadened to eliminate or reduce eligibility for government payments when farmers use pesticide practices that cause environmental damage. Any benefits to the Nation's land and water resources from such an approach would be limited to those resources operated or affected by participants.

The need for soil and water resource protection may extend beyond those geographic areas, farm types, or farm sizes most attracted to Federal programs. The eastern seaboard States have almost an equal amount of cropland potentially at risk from pesticides leaching into ground water as the Corn Belt, but receive significantly less in Federal program

Figure C-4
Federal Farm Program Payments, 1987



1 dot = $100,000.
Source: 1987 Census of Agriculture.

payments (1). Similarly, a concentration of highly erodible cropland exists in the Appalachian and Southeast regions where participation is relatively low.

Participation in Federal programs has been concentrated among cash grain farms. But the chemical use in the production of fruits, vegetables, and other specialty crops as well as on field crops produced by farms that specialize in dairy, beef, or swine are as susceptible to resource damage as cash grain farms. Similarly the largest and smallest farms, in terms of either acreage or value of sales, are frequently not attracted to Federal programs, although they account for a significant amount of cropland.

Because Federal price and income support programs have not been available nor attractive to all farmers, they do not offer protection to all land and water resources. As a result, any additional compliance requirements may not apply to the resources with the greatest need for protection.

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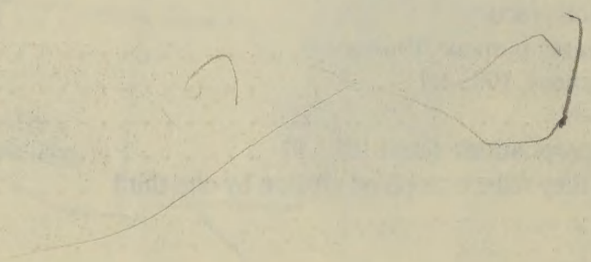

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